TM 11-5820-399-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

Do Not Do "X"

FIELD AND DEPOT MAINTENANCE MANUAL

RECEIVER-TRANSMITTERS, RADIO RT-246/VRC AND RT-524/VRC

HEADQUARTERS, DEPARTMENT OF THE ARMY
7 MAY 1962

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the +275-volt plate and power supply circuits, the +105-volt plate and power supply circuits, and the 115-volt alternating current circuits in the power supply, blower motor, and servo-system.

DON'T TAKE CHANCES!

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING ASSEMBLIES:

Power supply assembly A9000	700-volt circuits
Power amplifier assembly A6200	700-volt circuits

CAUTION

This equipment is transistorized. Do not make resistance measurements unless specifically directed.

Technical Manual

No. 11-5820-399-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
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RECEIVER-TRANSTMITTERS, RADIO RT-246/VRC AND RT-524/VRC

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CHAPTER 1

INTRODUCTION

1. Scope

a. This manual covers field and depot maintenance for Receiver-Transmitters, Radio RT-246/VRC and RT-524/VRC. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, repairing, aligning, and testing specified maintenance parts. It also lists tools, materials, and test equipment for third, fourth, and fifth echelon maintenance. The detailed functions of the RT-246/VRC and the RT-524/VRC are covered in the theory section.

b. Throughout this manual, the common name receiver-transmitter denotes both Receiver-Transmitter, Radio RT-246/VRC and Receiver-Transmitter, Radio RT-524/VRC. Most of the circuits are identical in both the RT-246/VRC and the RT-524/VRC. In some cases, however, although the functions are identical, the parts have different reference designations. When this is the case, the reference designation shown first is for the RT-246/VRC, and the one shown in parentheses is for the RT-524/VRC.

c. The receiver portion of the receiver-transmitter is similar to that of Receiver, Radio R-442/VRC and is covered in detail in TM 11-5820-409-35.

d. The complete technical manual for the RT-246/VRC and the RT-524/VRC includes TM 11-5820-399-20P and TM 11-5820-399-35P. Other applicable manuals are listed in paragraph 2.

e. Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Materiel Support Agency, Attn: SIGMS-PA2d, Fort Monmouth, N. J.

Note: For applicable forms and records, see paragraph 2, TM 11-5820-401-10.

f. Refer to DA Pamphlet 310-4 to determine what Changes to or revisions of this publication are current.

2. Applications

The RT-246/VRC is part of Radio Sets AN/VRC-12, AN/VRC-43, AN/VRC-44, and AN/VRC-45; the RT-524/VRC is part of Radio Sets AN/VRC-46, AN/VRC-47, AN/VRC-48, and AN/VRC-49. All of these radio sets provide mobile radio communications. For detailed instructions on planning and for operating the various radio sets within the system, refer to TM 11-5820-401-10. For organizational maintenance instructions, refer to TM 11-5820-401-20.

CHAPTER 2

THEORY

Section I. BLOCK DIAGRAM ANALYSIS

3. Transmitting Signal Path (fig. 1)

a. Voice signals developed in the microphone are amplified by the transmitter speech amplifier stage and applied to the transmitter 11.5-megacycle (mc) modulator stage. The transmitter 11.5-mc modulator consists of an oscillator and a frequency control circuit for the oscillator. Voice signals from the transmitter speech amplifier vary the oscillator at an audiofrequency (af) rate. The frequency control circuit is used to stabilize the frequency of the oscillator.

b. The frequency-modulated (fm) output from the transmitter 11.5-mc modulator and an 11.5-mc signal from the transmitter first and second intermediate frequency (if.) amplifier stages are applied to the transmitter phase discriminator. The two signals are compared in the transmitter phase discriminator to produce an audiofrequency output signal. This audiofrequency output is applied through the damping network to the transmitter master oscillator to correct oscillator drift.

c. The audiofrequency output from the damping network frequency-modulates the transmitter master oscillator. The modulated output from the transmitter master oscillator is amplified by the transmitter buffer and is coupled to the transmitter driver. The buffer amplifier isolates the transmitter master oscillator from the loading effects of the transmitter driver stage.

d. Two output signals are obtained from the transmitter buffer amplifier. One output signal is applied to the transmitter driver which amplifies the frequency-modulated radiofrequency (rf) signal voltage and couples it to the transmitter power amplifier. The other output signal is applied to the transmitter frequency control circuit (para 4) to develop a control voltage which is fed back through the transmitter phase discriminator and damping network to the transmitter master oscillator to correct oscillator drift.

e. The amplified output from the transmitter power amplifier stage is applied to the antenna-matching network through the coaxial relay. During transmission, the coaxial relay grounds the input circuit of the receiver very high frequency (vhf) tuner, and connects the transmitter power amplifier output to the antenna-matching network. This network matches the output impedance of the transmitter to the input impedance of the antenna circuit.

4. Transmitter Frequency Control Circuit (fig. 1)

a. One output signal from the transmitter buffer amplifier is applied to the receiver mixer. This signal is mixed with a signal from the receiver local oscillator, which is accurately controlled by a crystal reference system (TM 11-5820-409-35, para 4). The 11.5-output signal from the receiver mixer is amplified by the transmitter first and second if. amplifiers and applied to the transmitter phase discriminator where it is compared with the transmitter 11.5-mc modulator output.

b. The transmitter phase disciminator contains an error-correction voltage that is applied to transmitter master oscillator.

c. When the transmitter master oscillator is off frequency to the extent that the transmitter frequency control circuit cannot correct it, a hunt voltage, generated by the transmitter hunt generator, is applied through the damping network to the transmitter master oscillator which causes its frequency to shift. When the transmitter master oscillator frequency shifts within

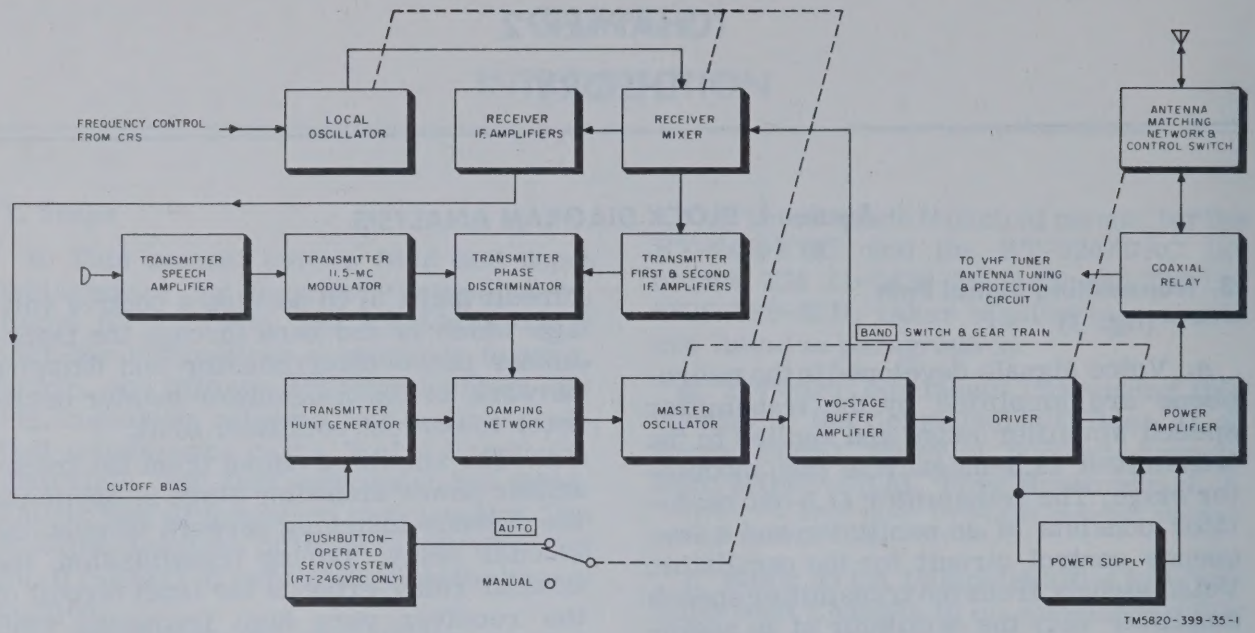


Figure 1. Receiver-Transmitters, Radio RT-246/VRC and RT-524/VRC, transmitting signal path, block diagram.

the lock-in range of the transmitter frequency control circuit, the frequency control circuit takes over to stabilize the transmitter master oscillator frequency.

d. With the transmitter master oscillator operating at the correct frequency, the proper frequency signal will be applied through the transmitter buffer amplifier to the receiver mixer where it will mix with the output of the receiver local oscillator to produce a receiver if. frequency of exactly 11.5 mc. The hunt generator circuit is inoperative when the transmitter oscillator frequency is within the lock-in range of the transmitter frequency control circuit.

5. Servosystem (fig. 1)

The servosystem, in the RT-246/VRC only, consists of the channel button assembly, the servoamplifier, the servo motor-generator, and a band switch motor. The servosystem functions each time a channel button is pressed. When retuning has been completed, the servosystem turns itself off and the RT-246/VRC remains on the desired channel until another channel selection is made. Any 10 of 920 available channels may be preselected by adjustment of the channel button assembly (TM 11-5820-401-20, para 8). Channel selection initiates either one of two operations. When the selected channel is in the same frequency band on which the RT-246/VRC is operating, the operation consists of retuning the adjustable components. When the selected channel is in another frequency band, retuning consists of exchanging some components, rearranging the electrical connection, and adjusting the value of other components. The affected components are connected into the servosystem by a gear train and mechanical linkage. The servosystem can tune the RT-246/VRC from its lowest (30.0-mc) to its highest (75.95-mc) operating channel in about 3 seconds.

6. Power Supply (fig. 2)

The power supply furnishes plate, screen, and bias voltages for the transmitter driver and power amplifier stages. The power supply also furnishes a 115-volt, 400 cycle-per-second (cps) output to operate the servosystem (RT-246/VRC only) and the blower motors.

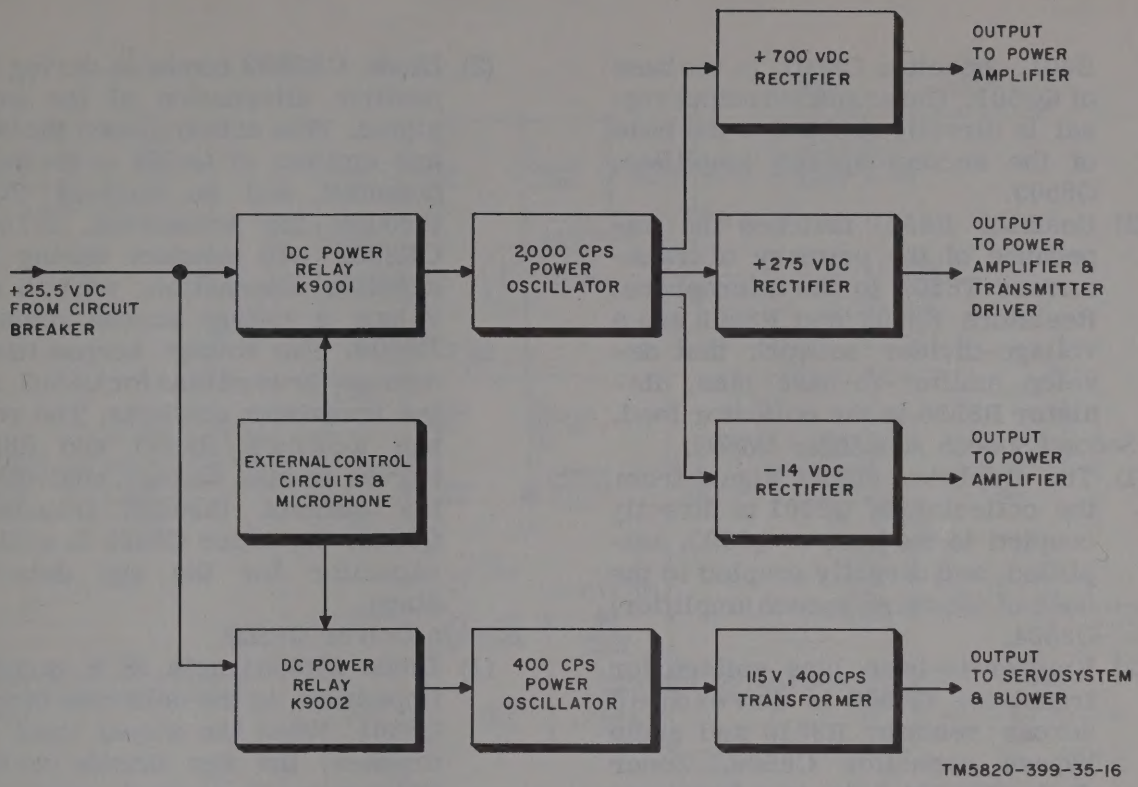


Figure 2. Power supply, block diagram.

a. Power Oscillators. Two power oscillators convert a 25.5-volt direct-current (dc) input to a high-voltage dc output. When dc power relays K9001 and K9002 are energized by the press-to-talk switch of the microphone or one of the external control circuits, the power oscillator circuits operate.

b. Dc Rectifier and Filter Circuits. The output of the 2,000-cps power oscillator is applied to the +700-volt dc rectifier and filter circuit, the +275-volt dc rectifier and filter circuit, and the -14-volt dc rectifier and filter circuit, to supply B+ and bias voltages for the driver and power amplifier stages.

c. 115-Volt Ac Output Circuit. The output of the 400-cps power oscillator is stepped up by the 115-volt, 400-cps transformer to supply operating voltage to the blower motor. In the R246/VRC, the 115-volt, 400-cps supply also powers the servosystem. The transistors for these two power converters are located on the receiver-transmitter case.

Section II. STAGE ANALYSIS

7. Transmitter Speech Amplifier Assembly A8500 (fig. 3)

The transmitter speech amplifier assembly amplifies the audiofrequency signals from the external microphone or a remote source. The assembly consists of a three-stage directly coupled class A amplifier and an automatic-gain-control (agc) detector and driver.

a. First Speech Amplifier Q8501.

(1) Local audio signals are coupled through transformer T8501 and C8501 to the base of transistor Q8501. Remote audio signals are applied through low-pass filter

Z401, capacitor C8501, to the base of Q8501. The amplified output signal is directly coupled to the base of the second speech amplifier, Q8503.

(2) Resistor R8501 matches the impedance of the primary of transformer T8501 to the microphone. Resistors R8502 and R8503 are a voltage-divider network that develop emitter-to-base bias. Resistor R8506 is the collector load.

b. Second Speech Amplifier Q8503.

(1) The amplified output signal from the collector of Q8501 is directly coupled to the base of Q8503, amplified, and directly coupled to the base of the third speech amplifier, Q8504.

(2) Emitter-to-base bias voltage for transistor Q8503 is developed across resistor R8510 and audio bypass capacitor C8506. Zener diode CR8504 acts as a temperature-compensating device. Inductor L8501 is the collector load.

c. Third Speech Amplifier Q8504.

(1) The audiofrequency output from Q8503 is directly coupled to the base of emitter follower transistor Q8504, amplified, and coupled through capacitor C8511 and low-pass filter FL8001, to the attenuator network (*f* below). Feedback voltage developed across resistor R8522 is applied through resistor R8508 to the emitter of transistor Q8501 to reduce distortion introduced in the af amplfier stages.

(2) Resistor R8520 limits collector current through Q8504. Emitter load resistor R8521 is bypassed for high frequencies by capacitor C8510.

d. Agc Detector.

(1) Feedback voltage from the collector of transistor Q8504 is coupled through capacitor C8508 and rectified by agc detector diodes CR8502 and CR8503. The negative alternation of the signal voltage is applied to the base of agc driver Q8502.

(2) Diode CR8503 conducts during the positive alternation of the input signal. This action places the base and emitter of Q8502 at the same potential and no current flows through the transistor. Diode CR8502 will conduct during the negative alternation, which develops a voltage across resistor R8509. The voltage across R8509 acts as forward bias for Q8502, and the transistor conducts. The voltage across R8509 and R8511 serves as bias voltage, controlling the current through transistor Q8502. Capacitor C8505 is a filter capacitor for the agc detector stage.

e. Agc Driver Q8502.

(1) Diode CR8501 acts as a variable impedance in the collector circuit Q8501. When the signal input increases, the agc driver current decreases (increased bias), the impedance of CR8501 increases, and a greater amount of out-of-phase feedback voltage is coupled through capacitor C8504 to the emitter of Q8501. This results in a decrease in the output of the first speech amplifier Q8501, thereby maintaining a relatively constant output signal voltage despite variations in the input signal level.

(2) Resistors R8507 and R8511 form a voltage divider that determines the base voltage for Q8502. Resistor R8504 and the impedance of diode CR8501, filtered by capacitor C8502, determine the emitter-to-base bias. Resistor R8505 and capacitor C8503 determine the collector-to-base voltage.

f. Attenuator Network.

(1) The output signal from the third speech amplifier Q8504 (*c* above) R8512, R8513, and R8516. This resistive network determines the output level of the speech amplifier signal coupled to the transmitter 11.5-mc modulator assembly A8100 (para 8).

(2) Fixed resistors R8512 and R8513,

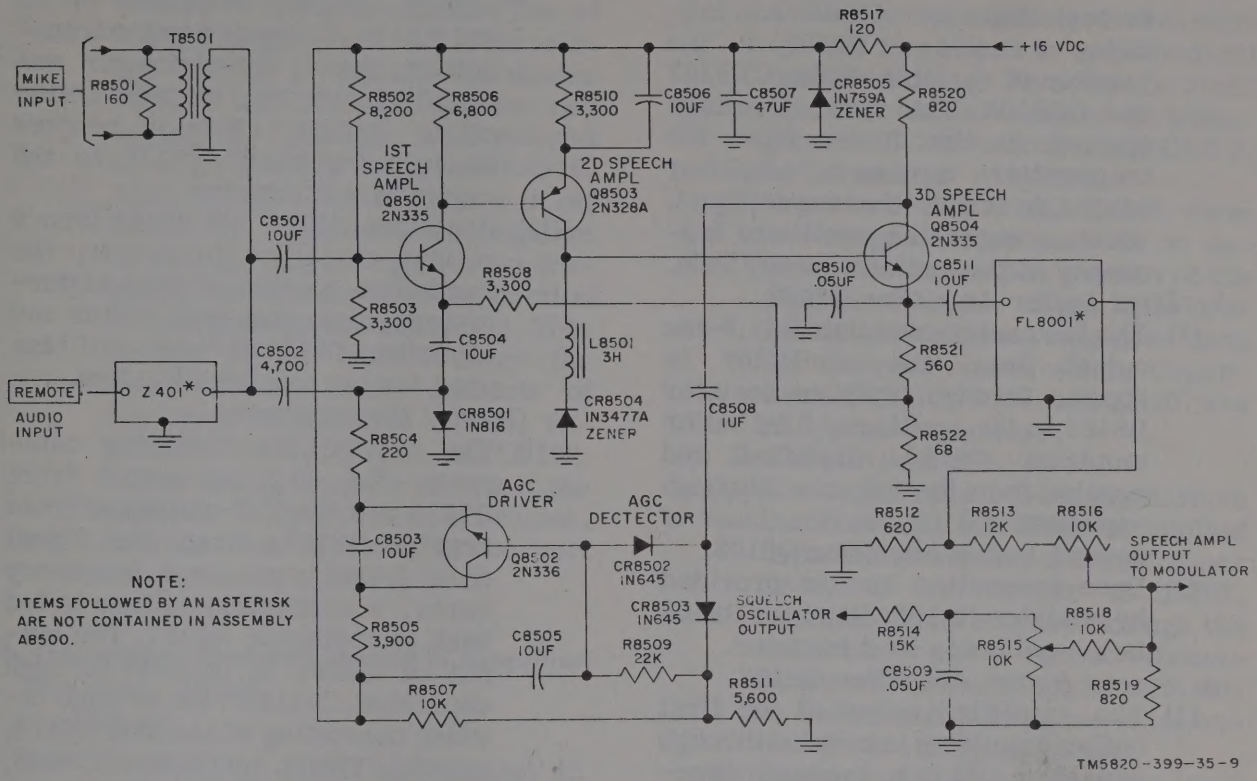


Figure 3. Transmitter speech amplifier assembly A8500, simplified schematic diagram.

variable resistor R8516, form a voltage divider to determine the audio output level delivered by the speech amplifier assembly.

g. Dc Voltage Distribution. Dc operating voltage for the speech amplifier assembly is provided at the junction of 12-volt zener diode CR8505 and voltage-dropping resistor R8517. Capacitor C8507 decouples the speech amplifier assembly from the 16-volt dc supply line.

h. Squelch Oscillator and Amplifier. Resistors R8514, R8515, R8518, and R8519, and capacitor C8509, are not a part of the speech amplifier but function as part of the 150-cps squelch tone oscillator (para 22).

8. Transmitter 11.5-Mc Modulator Assembly A8100 (fig. 4)

The output from speech amplifier assembly A8500 (para 7) modulates the oscillator in the 11.5-mc modulator assembly to provide a frequency-modulated 11.5-mc output. The assembly consists of a modified Colpitts oscillator and a three-stage afc circuit comprised of two buffer amplifiers and a crystal-controlled discriminator.

a. 11.5-Mc Oscillator Q8101.

(1) The oscillator-tuned circuit consists of transformer T8101, trimmer capacitor C8104, capacitors C8105 and C8106, and variable capacitance diodes CR8102 and CR8103. Capacitors C8105 and C8106 match the output impedance of the oscillator to the input impedance of the first buffer amplifier. Capacitor C8103 couples the output back to the emitter to sustain oscillation. Emitter-to-base bias is developed across resistor R8101 and capacitor C8101. Base bias is developed at the junction of R8102, 5.5-volt zener diode CR8101, and capacitor C8102.

(2) The audiofrequency output from the speech amplifier is coupled

through capacitor C8107 and isolating resistor R8103 to the junction of variable diodes CR8102 and CR8103. The varying voltage applied to the diodes from the transmitter speech amplifier varies their effective capacitance, which changes the oscillator frequency at the audiofrequency rate.

b. First Buffer Amplifier Q8102.

(1) The frequency-modulated 11.5-mc output from the oscillator is applied through isolation resistor R8104 to the emitter of first buffer amplifier Q8102, amplified, and coupled from the collector, through capacitor C8109, to the base of second buffer amplifier Q8103.

(2) Base-to-emitter bias is provided by resistor R8105. Resistor R8106 is the collector load resistor.

c. Second Buffer Amplifier Q8103.

(1) The amplified output of the first buffer amplifier is coupled through capacitor C8109 to the base of second buffer amplifier Q8103, and amplified. A portion of the output voltage obtained from this stage: from the junction of collector load-voltage dividing resistors R8111 and R8112, is applied to the transmitter phase discriminator assembly (para 10); the total Q8103 output voltage other is coupled through capacitor C8114 to the crystal discriminator.

(2) Resistors R8107 and R8108 form a voltage divider to develop the fixed-bias portion of the emitter-to-base bias. Resistor R8109 and capacitor C8111 develop self bias used for current stabilization.

d. Crystal Discriminator.

(1) The crystal discriminator compares the 11.5-mc output from Q8103 with the 11.5-mc output from crystal Y8101. When the signal from Q8103 contains a frequency error, a correction voltage is fed back to oscillator Q8101. The output of Q8103 is coupled through capacitor C8114 to the voltage divider consisting of resistor R8113, crystal Y8101, capacitor C8116, and inductor L8101. The tuned circuit consisting of L8101 and C8116 is in series with crystal Y8101 and improves the stability of the

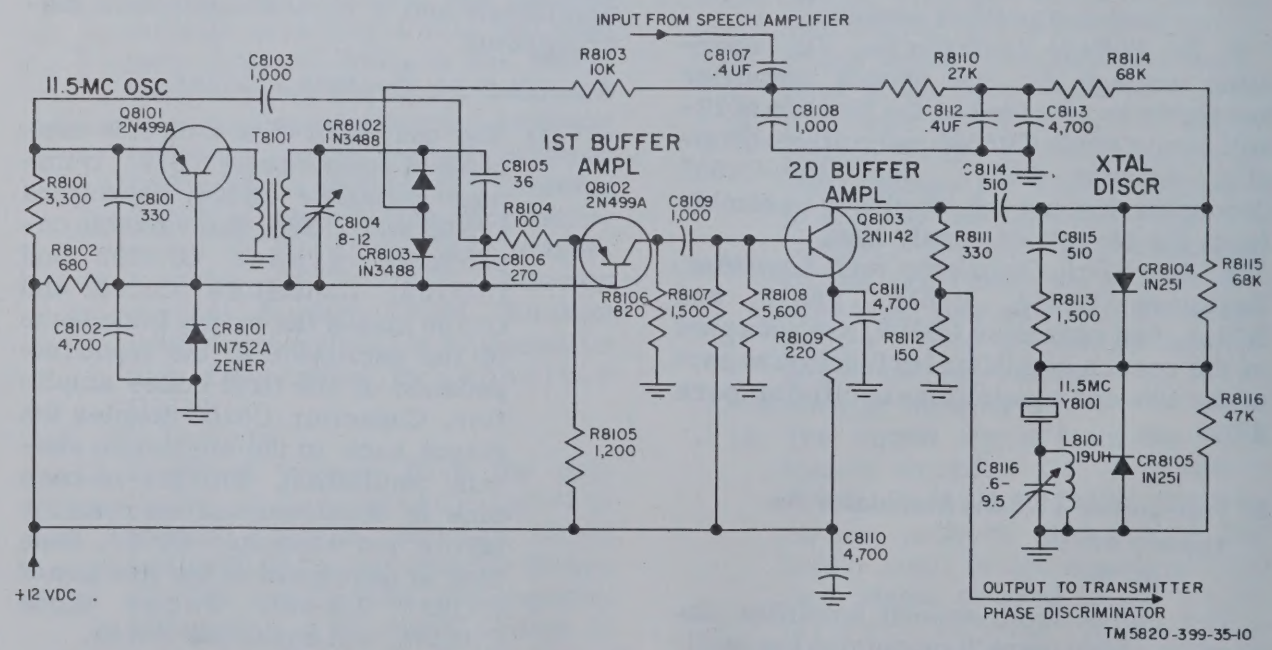


Figure 4. Transmitter 11.5-mc modulator assembly A8100, simplified schematic diagram.

crystal oscillator circuit. The rf voltage across each half of the voltage divider is rectified by diodes CR8104 and CR8105, and the resulting dc voltage is developed across resistors R8515 and R8516.

(2) When the 11.5-mc oscillator is off frequency, a positive or negative dc voltage (depending on error frequency) is developed at the junction of resistors R8115 and R8114. This voltage is fed back through the filter circuit, which consists of resistors R8114 and R8110, capacitors C8113, C8112, and C8108, and isolating resistor R8103, to the variable capacitance diodes, CR8102 and CR8103, to correct the oscillator frequency.

9. Transmitter First and Second If. Amplifier Assembly A8300 (fig. 5)

The transmitter first and second if. stages amplify the 11.5-mc signal from the receiver mixer (TM 11-5820-409-35, para 37). The amplified output from the second if. amplifier is applied to the transmitter phase discriminator (para 10).

a. First If. Amplifier Q8302.

(1) The 11.5-mc if. signal from the receiver mixer is coupled through the tuned circuit, which consists of transformer T8303 and capacitor C8308, to the emitter of transistor Q8302. The signal is amplified and coupled through the collector tuned circuit, which consists of transformer T8302 and capacitor C8309, to the emitter of Q8301.

(2) Resistors R8307 and R8308 form a voltage-divider network to develop the fixed-bias portion of the emitter-to-base bias. Resistor R8306 establishes self-bias used for current stabilization. Capacitors C8305, C8306, and C8307 are rf bypass capacitors.

b. Second If. Amplifier Q8301.

(1) The amplified 11 5-mc signal from the first if. amplifier is applied from the secondary of transformer T8302 to the emitter of Q8301, amplified, and coupled through the collector tuned circuit (transformer T8301 and capacitor C8301) to the transmitter phase discriminator assembly (para 10).

(2) Resistor R8301 dampens the input variations to prevent the oscillations in the if. amplifier. Resistors R8303 and R8304 form a voltage-divider network to develop the fixed-bias portion of the emitter-to-base bias, and resistor R8302 establishes self-bias used for current stabilization. Capacitors C8302, C8303, and C8304 are rf bypass capacitors.

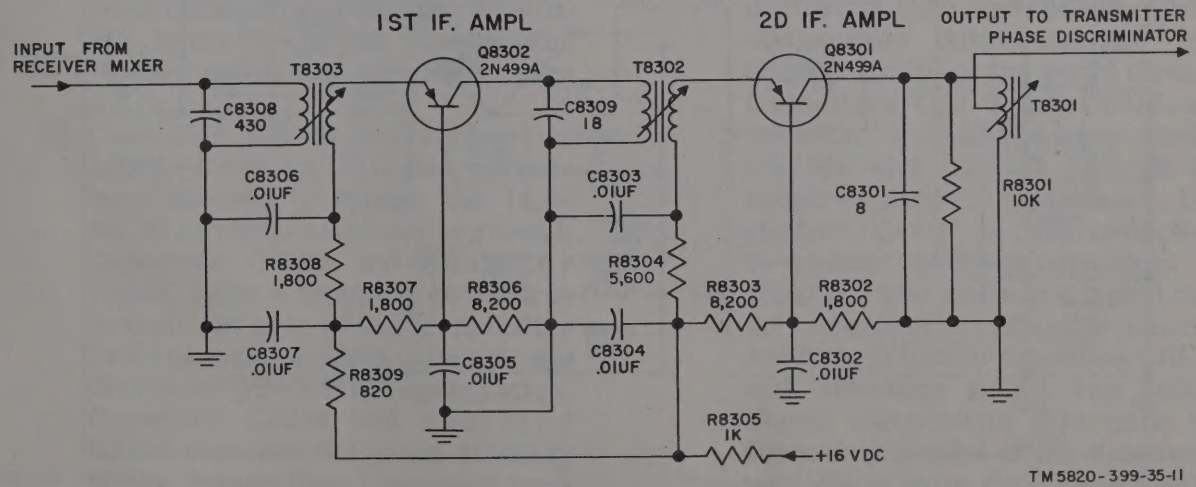


Figure 5. Transmitter first and second if. amplifier assembly A8300, simplified schematic diagram.

c. Dc Voltage Distribution. Sixteen-volt dc operating voltage for the transmitter first and second if. amplifier assembly is dropped to the proper value by voltage-dropping resistors R8305 and R8309.

10. Transmitter Phase Discriminator Assembly A8200 (fig. 6)

The transmitter phase discriminator assembly consists of two driver-amplifier stages and a ring modulator. Two input signals are applied to the assembly, one from the 11.5-mc transmitter modulator assembly (para 8), and the other from the transmitter first and second if. amplifier assembly (para 9). These two 11.5-mc signals are amplified by the two driver stages and applied to the ring modulator. The ring modulator compares the two signals and develops an output voltage that is used for modulation and frequency error correction of the transmitter master oscillator.

a. Driver Q8201.

(1) The output of the transmitter 11.5-mc modulator assembly (para 8) is applied to a tuned circuit consisting of transformer T8201 and capacitor C8201. The voltage across the secondary of T8201 is amplified by Q8201 and coupled from the collector, through the tuned circuit consisting of the primary of transformer T8202 and capacitor C8205, to the link between transformers T8202 and T8203. Link coupling is used to reduce stray capacitive coupling to the ring modulator.

(2) Resistor R8204 broadens the bandpass of the output tuned circuit. Resistors R8202 and R8203 form a voltage-divider network to develop the fixed-bias portion of the emitter-to-base bias. Resistor R8201 and capacitor C8202 form a base-decoupling network. Capacitors C8203 and C8204 are rf bypass capacitors.

b. Driver Q8202.

(1) The 11.5-mc output from the transmitter first and second if. amplifier assembly is applied to the emitter of driver transistor Q8202 through capacitor C8212. The amplified output of Q8202 is coupled

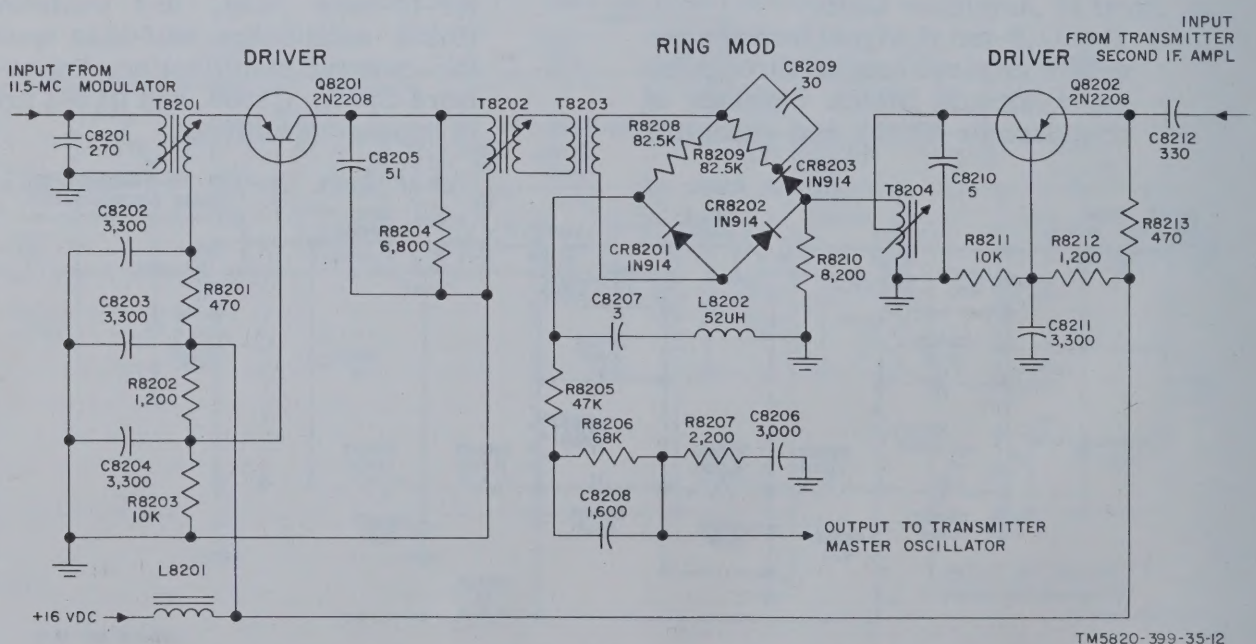


Figure 6. Transmitter phase discriminator assembly A8200, simplified schematic diagram.

from the collector, through the tuned circuit consisting of autotransformer T8204 and capacitor C8210, to the ring modulator.

(2) Resistor R8210 broadens the bandpass of the output tuned circuit. Resistors R8211 and R8212 form a voltage-divider network to develop the fixed-bias portion of the emitter-to-base bias. Resistor R8213 provides additional biasing for the emitter. Capacitor C8211 is an rf bypass capacitor.

c. Ring Modulator.

(1) The 11.5-mc output from driver Q8201 is applied through transformer T8203 to the bridge circuit, which consists of diodes CR8201, CR8202 and CR8203, resistors R8208 and R8209, and capacitor C8209. The 11.5-mc output from driver Q8202 is also applied through transformer T8204 to the bridge circuit. The two signals are compared by the ring modulator to produce both an audio output, determined by the modulation, and a dc voltage, determined by the difference between the two rf frequencies. The resulting audiofrequency voltage and dc error voltage is developed across resistors R8205 and R8206, and applied through the low-pass filter in the transmitter hunt generator assembly (para 17) to the transmitter master oscillator assembly (para 11).

(2) Capacitor C8207 and inductor L8202 form an 11.5-mc series-tuned circuit to bypass the 11.5-mc rf carrier frequency to ground. Capacitor C8206 and resistor R8207 form a damping network to reduce the gain of the transmitter frequency control circuit and therefore prevent regeneration. Capacitor C8208 and resistor R8206 increase the phase stability of the transmitter frequency control circuit.

11. Transmitter Master Oscillator Assembly A6300 (fig. 7)

The transmitter master oscillator is a modified Colpitts oscillator circuit using variable capacitance diodes and a variable inductance tuner to generate frequencies from 30.0 to 52.95 mc in band A, and 53.0 to 75.95 mc in band B. The master oscillator has tuned circuits for both bands which share the variable inductance tuner. In the RT-246/VRC, the tuned circuits are switched from one band to the other by the band switch motor, and the variable inductance tuner is operated by the servosystem (para 18). In the RT-524/VRC, these functions are accomplished manually.

a. Master Oscillator Q6301. Transistor Q6301 functions as a common base Colpitts oscillator circuit. Resistors R6306 and R6307 form a voltage-divider network to develop the fixed-bias portion of the emitter-to-base bias, and resistor R6305 establishes self-bias used for current stabilization. The output signal from the master oscillator is coupled through capacitor C6310 and impedance-matching resistor R6308 to the transmitter buffer amplifier assembly (para 12). The desired collector tuned circuit is selected by switch S6301.

(1) *Band A.* The collector tuned consists of variable inductor L6001A, trimmer capacitor C6314, and inductors L6305 and L6303. These components determine the frequency limits of the tuned circuit. Capacitors C6315 and C6316, and variable capacitance diodes CR6301 and CR6302 provide the required circuit capacitance. Capacitor C6306 is the collector-to-emitter feedback capacitor.

(2) *Band B.* The collector tuned circuit consists of variable inductor L6001A, trimmer capacitor C6313, and inductors L6304 and L6302. These components determine the frequency limits of the tuned circuit. Capacitors C6311 and C6312, and variable capacitance diodes

CR6301 and CR6302 provide the required circuit capacitance. Capacitor C6305 is the collector-to-emitter feedback capacitor.

b. Variable Capacitance Diode Circuit. The transmitter master oscillator frequency is controlled by the action of the variable capacitance diode circuit. The circuit consists of the effective capacitance of diodes CR6301 and CR6302, which are reverse biased by the 6.3-volt dc line. Resistors R6303 and R6304, and capacitors C6303 and C6304 form a decoupling network from the 6.3-volt dc line. Any change in the bias on these diodes changes their effective capacitance. As the voltage applied from the transmitter phase discriminator assembly (para 10) varies, the capacitance of the diodes vary, and the transmitter master oscillator frequency changes at the audio-frequency rate. Capacitor C6308 couples the diode circuit to the master oscillator band A tuned circuit, and capacitor C6307 couples the diode circuit to the master oscillator band B tuned circuit. Resistor R6302 and capacitor C6301 form a low-pass filter for the signal applied from the transmitter frequency control circuit. Resistor R6301 is the load resistor for the transmitter frequency control circuit. Inductor L6301 and capacitor C6302 form an rf trap to isolate the transmitter master oscillator from the variable capacitance diode circuit.

12. Transmitter Buffer Amplifier Assembly A6400 (fig. 8)

The transmitter buffer amplifier assembly consists of an isolation amplifier and a buffer stage. The isolation amplifier isolates the transmitter master oscillator to maintain frequency stability. The buffer increases the master oscillator output level to operate the driver stage. The transmitter buffer amplifier assembly furnishes two output signals; one is applied to the transmitter driver (para 14),

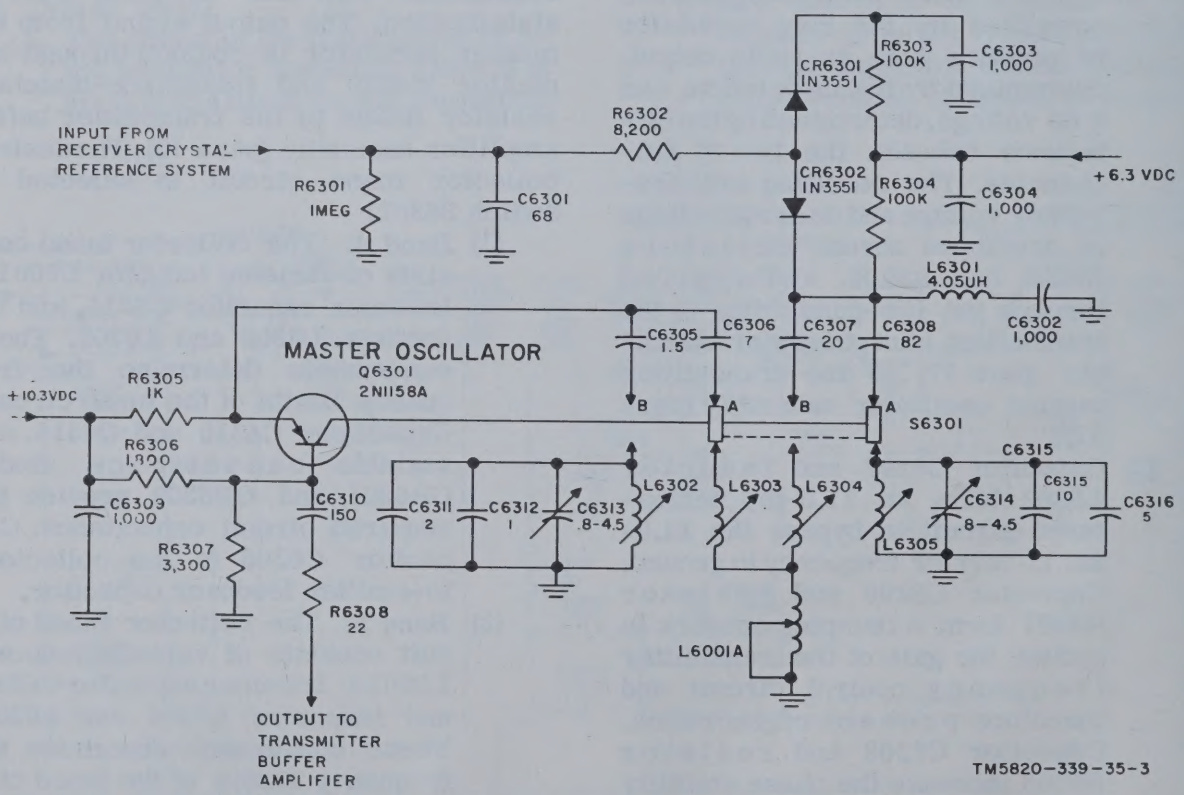


Figure 7. Transmitter master oscillator assembly A6300, simplified schematic diagram

and the other is applied to the receiver mixer to develop afc voltage (TM 11-5820-409-35, para 37).

a. Isolation Amplifier Q6401.

(1) The output from the transmitter master oscillator (para 11) is developed across R6402 and applied to the base of transistor Q6401. The amplified output is applied from the collector to the primary of transformer T6401.

(2) Resistors R6401 and R6402 form a voltage-divider network to develop fixed emitter-to-base bias for the stage. Resistor R6403 and rheostat R6404 determine emitter-to-base bias and regulate the overall gain of the stage. Capacitor C6401 is an rf bypass capacitor which prevents emitter degeneration.

b. Buffer Q6402.

(1) The output from the isolation amplifier stage is developed across the two secondary windings of transformer T6401; one winding couples the signal to the transmitter frequency control circuit, and the other winding couples the signal through impedance-matching resistor R6406 and coupling capacitor C6402 to the emitter of transistor Q6402. The amplified output signal from the collector is coupled through capacitor C6404 to the collector tuned circuit. Switch S6401 selects the desired tuned circuit.

(2) Resistor R6405 broadens the bandwidth of the secondary of transformer T6401. Resistors R6408 and R6409 form a voltage-divider network to develop fixed emitter-to-base bias. Resistor R6407 provides the emitter impedance. Inductor L6401 is the collector load. Capacitor C6403 maintains the base at rf ground.

c. Collector Tuned Circuits. The buffer stage has collector tuned circuits for both bands A and B. Switch S6401 selects one of the circuits that share a variable inductance tuner. In the RT-246/VRC, the tuned circuits are switched from one band to the other by the band switch motor, and the variable inductance is driven by the servosystem (para 18). In the RT-524/VRC, these functions are accomplished manually.

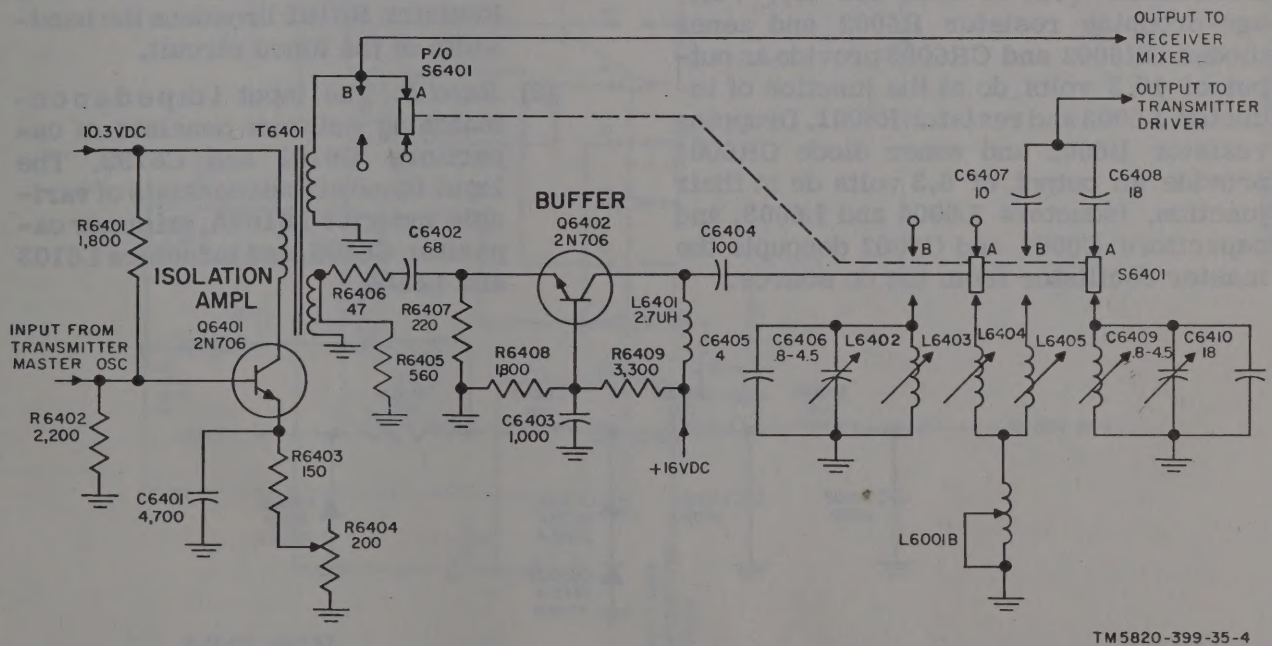


Figure 8. Transmitter buffer amplifier assembly A6400, simplified schematic diagram.

(1) *Band A.* The frequency limits of the collector tuned circuit are determined by variable inductors L6001B, L6403, and L6405, and trimmer capacitor C6409. Capacitor C6410 provides the required circuit capacitance. Capacitor C6408 couples the output of the buffer amplifier to the driver stage (para 14).

(2) *Band B.* The frequency limits of the collector tuned circuit are determined by variable inductors L6001B, L6402, and L6404, and trimmer capacitor C6406. Capacitor C6405 provides the required circuit capacitance. Capacitor C6407 couples the output of the buffer amplifier to the driver stage (para 14).

13. Voltage Regulator Assembly A6000 (fig. 9)

The voltage regulator assembly provides 10.2 and 6.3 volts dc to master oscillator assembly A6300 (para 11), and buffer amplifier assembly A6400 (para 12). An input voltage of 16 volts dc is supplied by the main voltage regulator in the receiver-transmitter (TM 11-5820-409-35). Voltage-dropping resistor R6002 and zener diodes CR6002 and CR6003 provide an output of 10.3 volts dc at the junction of inductor L6003 and resistor R6001. Dropping resistor R6001 and zener diode CR6001 provide an output of 6.3 volts dc at their junction. Inductors L6004 and L6003, and capacitors C6001 and C6002 decouple the master oscillator from the dc source.

14. Transmitter Driver Assembly A6100 (fig. 10)

The transmitter driver is a tuned grid tuned plate, class AB amplifier which amplifies the frequency-modulated (fm) signal from the transmitter buffer amplifier stage (para 12) to drive the transmitter power amplifier stage (para 15).

a. Input Tuned Circuit. The output signal from the transmitter buffer amplifier stage is coupled through an impedance network, input tuned circuit, through capacitor C6106, to the grid of driver V6101. Separate tuned circuits with a common variable inductor are used for bands A and B. Switch S6101A selects the desired circuit. In the RT-246/VRC, the tuned circuits are band switched by the band switch motor and the variable inductance is driven by the servosystem (para 18). In the RT-524/VRC, these functions are accomplished manually.

(1) *Band A.* The input impedance-matching network consists of resistor R6105 and capacitors C6117 and C6118. The input tuned circuit consists of variable inductor L6109A, trimmer capacitor C6103, and inductors L6102 and L6101. Resistor R6101 broadens the bandwidth of the tuned circuit.

(2) *Band B.* The input impedance-matching network consists of capacitors C6101 and C6102. The input tuned circuit consists of variable inductor L6109A, trimmer capacitor C6105, and inductors L6103 and L6104.

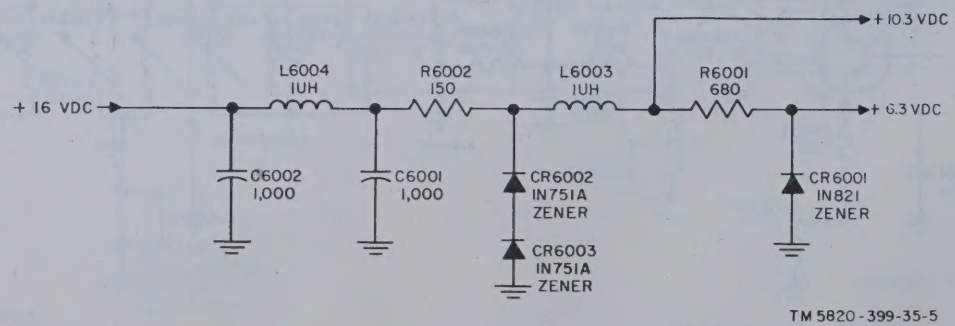


Figure 9. Voltage regulator assembly A6000, simplified schematic diagram.

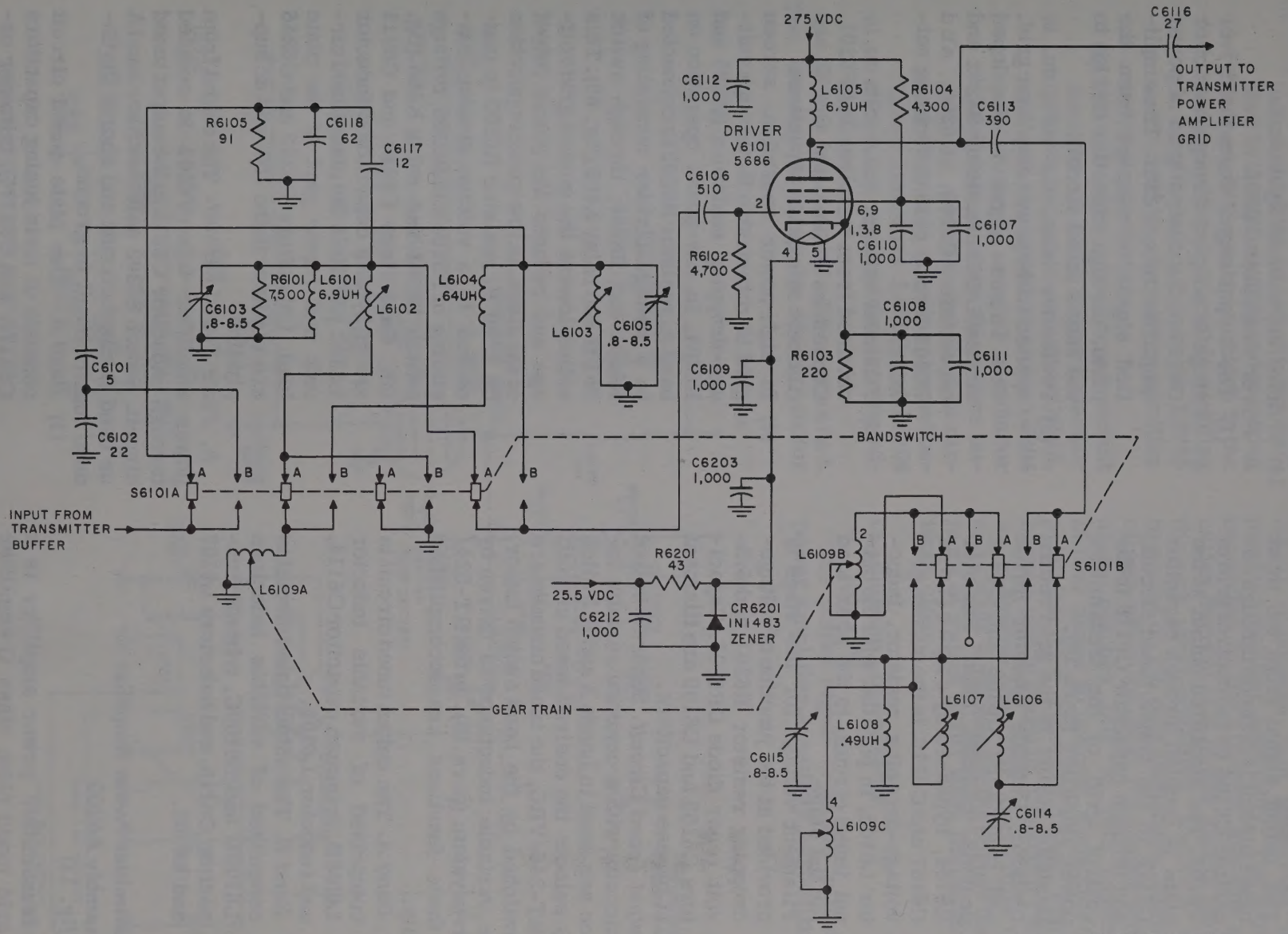


Figure 10. Transmitter driver assembly A6100, simplified schematic diagram.

b. Driver V6101.

(1) The output signal from the input tuned circuit is coupled through capacitor C6106 to the control grid of V6101. The amplified output at the plate is coupled through capacitor C6113 to the output tuned circuit, and through capacitor C6116 to the control grid of the transmitter power amplifier (para 15).

(2) Resistor R6102 is the grid return resistor. Cathode resistor R6103 and capacitors C6108 and C6111 provide cathode bias. Resistor R6104, bypassed by capacitors C6107 and C6110, is the screen grid voltage-dropping resistor. Inductor L6105, in parallel with the output tuned circuit, is the plate load for the stage.

(3) Filament voltage for the stage is provided at the junction of voltage-dropping resistor R6201 and 6.3-volt zener diode CR6201. Capacitors C6203 and C6109 are filament rf bypass capacitors.

c. Output Tuned Circuit. Separate output tuned circuits with a common variable inductance are used in bands A and B. Switch S6101B selects the desired tuned circuit. In the RT-246/VRC, the tuned circuits are band switched by the band switch motor, and the variable inductance is driven by the servosystem (para 18). In the RT-524/VRC, these functions are accomplished manually.

(1) *Band A.* The output tuned circuit is comprised of variable inductor L6106B, trimmer capacitor C6114, and inductor L6106.

(2) *Band B.* The output tuned circuit is comprised of variable inductors L6109B and L6109C, trimmer capacitor C6115, and inductors L6107 and L6108.

15. Transmitter Power Amplifier Assembly A6200 (fig. 11)

The transmitter power amplifier is a tuned grid tuned plate class C amplifier which amplifies the frequency-modulated signal from the transmitter driver (para 14) to drive the antenna system.

a. Power Amplifier V6201.

(1) The output signal from the driver stage is coupled through capacitor C6116 to the control grid of power amplifier tube V6201. The amplified signal is coupled from the plate, through capacitor C6215, to the output tuned circuit.

(2) Protective bias, -14 volts dc, is applied to the power amplifier grid. The input signal is developed across L6201. Resistor R6202 and capacitors C6205, C6206, and C6209 form a grid decoupling network.

(3) Filament voltage, +25.5 volts dc, is obtained from terminal 1 of P6201. Capacitors C6208 and C6212 are filament rf bypass capacitors.

(4) In high-power operation, screen grid is returned to B+ through voltage-dropping resistors R6203 and R6204. In low-power operation on band A, resistor R6203 is connected to a voltage divider consisting of R6204 and R6206; through switch S6102 and relay K406 (fig. 69). This action lowers the screen grid voltage and reduces the power output of the stage. In low-power operation on band B, resistor R6203 is connected to a voltage divider consisting of R6204 and R6205, through switch S6201 and relay K406 (fig. 69). Capacitors C6210 and C6211 are rf bypass capacitors. Inductor L6202 parallels the plate tuned circuit and forms part of the plate load. Capacitors C6213 and C6216 are rf filters in the 700-volt dc supply line.

b. Plate Tuned Circuit. The output from power amplifier tube V6201 is coupled through capacitor C6215 to the output tuned circuit. Switch S6202 selects either band A or band B tuned circuit and shorts the unused tuned circuit to ground.

(1) *Band A.* The plate tuned circuit consists of main tuning capacitors C6217A and C6217B, trimmer capacitor C6219, and inductor L6206.

Inductor L6205 is inductively coupled to inductor L6206 and provides the proper impedance match to the antenna circuit. Variable coupling is used between inductors L6205 and L6206 to permit transmitter loading adjustments.

(2) *Band B.* The plate tuned circuit consists of main tuning capacitor C6217A, trimmer capacitor C6218, and inductor L6203. Inductor L6204 is inductively coupled to inductor L6203 and provides the proper impedance match to the antenna circuit. Variable coupling is used between inductors L6203 and L6204 to permit transmitter loading adjustments.

c. Blower Motor and Thermostat. The blower, powered by blower motor B6201 dissipates heat generated in the power amplifier assembly. The motor is connected to the 115-volt, 400-cps alternating current (ac) power supply (para 21) through heat-sensitive switch S6201 mounted on the heat exchanger. The switch closes when the heat exchanger temperature reaches 140° F; this causes the blower motor to operate. Capacitor C6202 provides the required phase shift for blower motor starting. Capacitor C6207 is an rf bypass capacitor. Capacitors C6201 and C6204 suppress arcing across the contacts of switch S6201 when the switch contacts close.

16. Antenna Coaxial Relay (fig. 69)

The output signal from the transmitter power amplifier assembly A6200 (para 15)

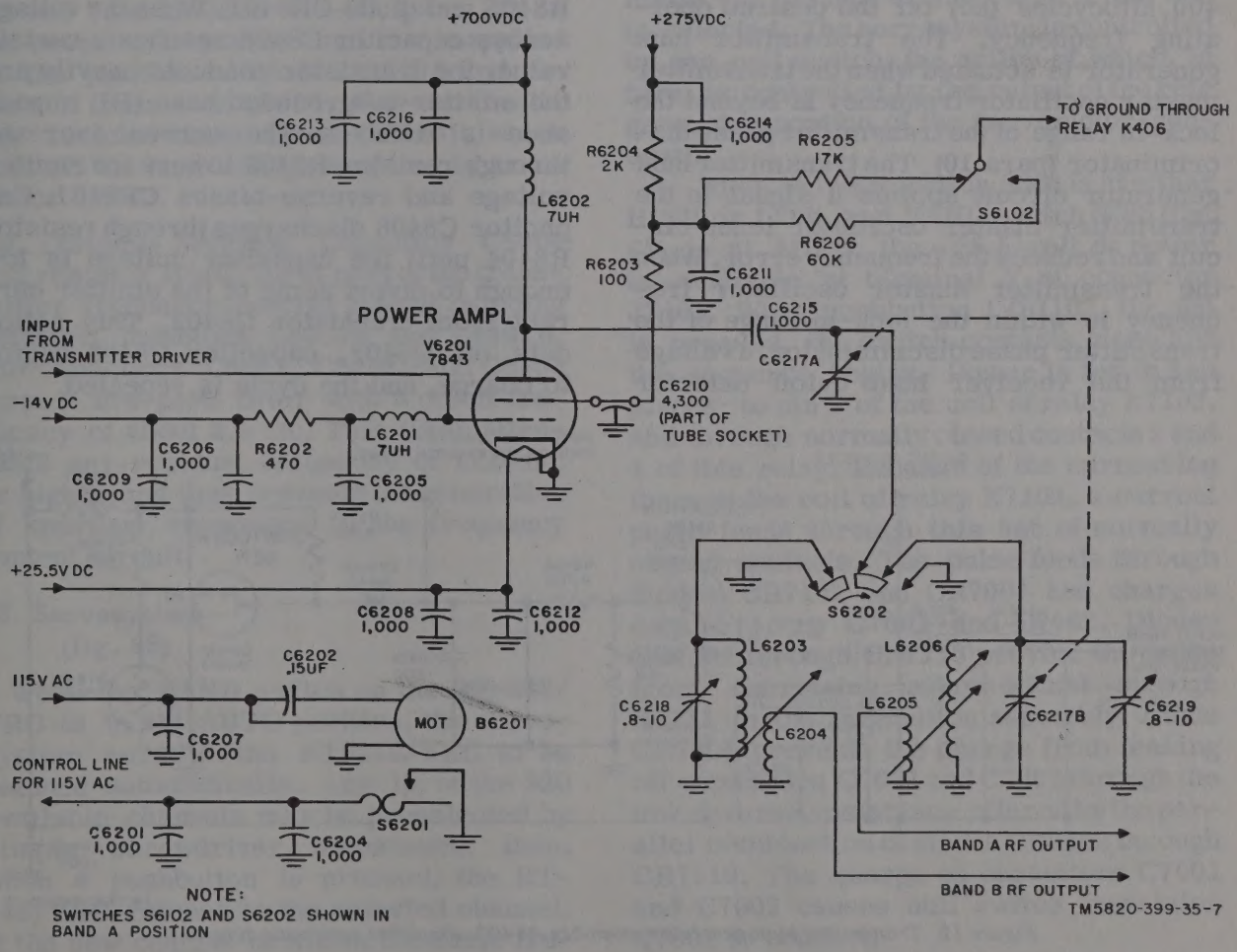


Figure 11. Heat exchanger and power amplifier assembly A6200, simplified schematic diagram.

is applied through filter FL401 in the band A position to antenna coaxial relay K301. Filter FL401 attenuates the band B harmonics in the band A output. In the band B operation, the output from the power amplifier assembly is applied directly to K301. When deenergized, K301 connects the antenna to the receiver vhf tuner and grounds the transmitter power amplifier output circuit. When energized, relay K301 connects the power amplifier output, either band A or B (depending on the position of switch S307 (S357 and S358)) to the antenna, and grounds the receiver input circuit.

17. Transmitter Hunt Generator Assembly A8400
(fig. 12)

Mechanical positioning errors and temperature changes may cause the transmitter master oscillator to be as much as 400 kilocycles (kc) off the desired operating frequency. The transmitter hunt generator is actuated when the transmitter master oscillator frequency is beyond the lock-in range of the transmitter phase discriminator (para 10). The transmitter hunt generator circuit applies a signal to the transmitter master oscillator tuned circuit and reduces the frequency error. When the transmitter master oscillator frequency is within the lock-in range of the transmitter phase discriminator, a voltage from the receiver hunt cutoff detector (TM 11-5820-409-35, para 38) biases the transmitter hunt generator to cutoff.

a. Sawtooth Generator Q8402. A unijunction transistor, Q7402, which functions in a similar manner to that of a thyratron tube in a relaxation oscillator circuit, produces the sawtooth hunt signal. A voltage divider, which consists of resistors R8407 and R8406 and thermistor RT8401, establishes the required voltage between the two bases, B1 and B2, of transistor Q8402. Thermistor R8401 maintains a constant amplitude output voltage over the operating temperature range. A network comprised of R8404, CR8401, R8405, and C8408 establishes a forward bias between the emitter and grounded base B1 of transistor Q8402. This forward bias determines the frequency of the sawtooth voltage output. When dc voltage is applied, capacitor C8408 begins to charge through resistor R8405 and diode CR8401. When the voltage across capacitor C8408 reaches a certain value, the transistor conducts heavily and the emitter-to-grounded base (B1) impedance is reduced. The current increase through resistor R8405 lowers the emitter voltage and reverse-biases CR8401. Capacitor C8408 discharges through resistor R8404 until the capacitor voltage is low enough to divert some of the emitter current from transistor Q8402. This action cuts off Q8402, capacitor C8408 begins to charge, and the cycle is repeated.

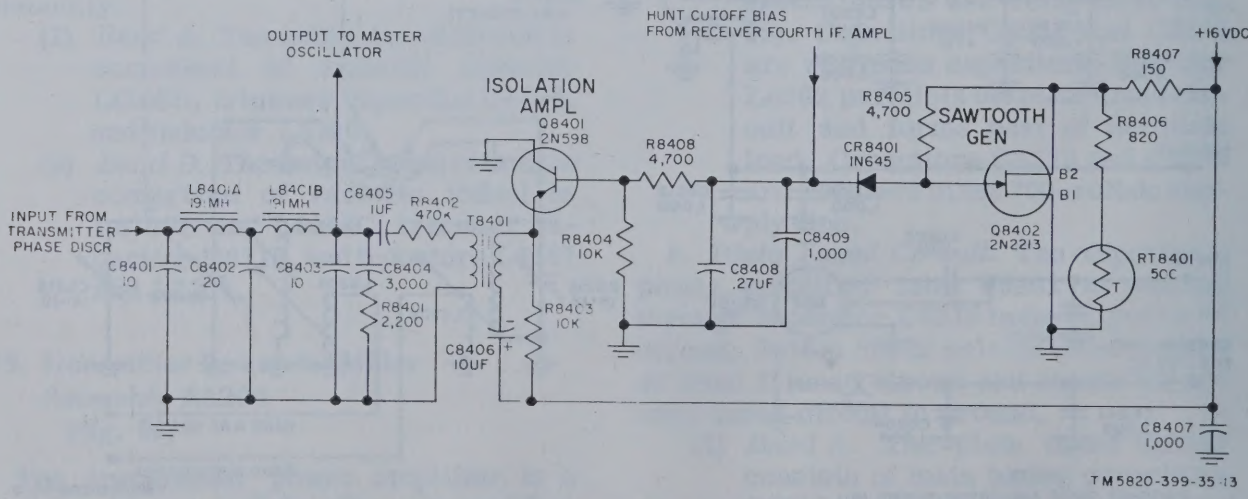


Figure 12. Transmitter hunt generator assembly A8400, simplified schematic diagram.

b. Isolation Amplifier Q8401. The sawtooth voltage across capacitor C8408 is applied to the base of transistor Q8401. This stage isolates the sawtooth generator circuit from the transmitter phase discriminator (para 10). The primary winding of transformer T8401 is the load for emitter follower transistor Q8401. Resistor R8403 and capacitor C8406 determine the emitter-to-base bias for the stage. Transformer T8401 couples the output of Q8401 to the damping circuit. Resistor R8402 and capacitor C8405 prevents loading of the transmitter phase discriminator by the hunt generator.

c. Transmitter Hunt Generator Cutoff Circuit. When the transmitter master oscillator frequency is corrected by the hunt generator, the signal strength through the receiver if. section increases. A bias voltage taken from the hunt cutoff detector circuit (TM 11-5820-409-35, para 38) in the receiver frouth if. amplifier is applied to the junction of diode CR8401 and the base of transistor Q8401. This cutoff voltage reverse-bases diode CR8401, which cuts off the hunt voltage supplied by transistor Q8402.

d. Damping Network. Capacitor C8404 and resistor R8401 form part of the transmitter frequency control circuit damping network. Inductors L8401A and L8401B, and capacitors C8401, C8402, and C8403 form a low-pass filter with a cutoff frequency of about 2.5 mc. This filter attenuates any residual frequency of 11.5-mc or higher and thus prevents the generation of spurious responses in the frequency control circuit.

18. Servosystem (fig. 68)

When the BAND switch on the RT-246/VRC is in its AUTO position, the servosystem permits the RT0246/VRC to be retuned automatically. Any 10 of the 920 available channels may be preselected by simple screwdriver adjustment; then, when a pushbutton is pressed, the RT-246/VRC retunes to the selected channel. If the new channel is within the same frequency band on which the RT-246/VRC is operating, retuning consists only of adjusting rf components to new values. If the new channel is not within the same frequency band, returning consists of exchanging some components, rearranging the electrical connection of others, and adjusting them to new values. Affected components are connected into the servosystem by a gear train and mechanical linkage. The servosystem can tune the RT-246/VRC from its lowest (30.0-mc) to its highest (75.95-mc) operating channel in about 3 seconds.

a. The servosystem consists of the pushbuttom assembly, the servoamplifier, null switch, phase-shift network, servomotor-generator, band switch motor, and gear train. The servosystem functions each time a pushbutton is pressed. When retuning is completed, the servosystem turns itself off and the RT-246/VRC remains on the new channel until a new one is selected. The servosystem is controlled by the null switch, the action of which, in turn, is controlled by the output of the rate generator portion of the servomotor-generator.

b. When POWER switch S304 is at either HIGH or LOW, and BAND switch S305 (fig. 69) is at AUTO, the +25.5-volt dc power is available at terminal Y of connector J7101. When pushbutton 1 (S7102, fig. 68) is pressed, the switch contacts close and the sequence begins. Power is fed to two places: to pin 7 of the coil of relay K7102, and through normally closed contacts 2 and 4 of this relay. Because of the current lag through the coil of relay K7102, a current pulse feeds through this set of normally closed contacts. The pulse feeds through diodes CR7101 and CR7004 and charges capacitors C7001 and C7002. Diodes CR7102 through CR7110 prevent the pulse from energizing relay K7103 through K7111 in the pushbutton assembly. Diode CR7004 prevents the charge from leaking off capacitors C7001 and C7002 through the low reverse resistance offered by the parallel combination of diodes CR7102 through CR7110. The charge on capacitors C7001 and C7002 causes null switch transistor Q7001 to conduct.

c. Relay K7102 energizes; this applies

+25.5-volt dc power through switch S7103 and diode CR404 or diode CR405 to band switch motor B401. Band switch motor B401 is a high-speed dc motor with a gear reduction head. It is mechanically connected to rf components in the receiver tuner and in the transmitter oscillator buffer, driver, and power amplifier stages. It is also connected to the antenna coaxial relay. Band switch motor B401 switches these components from one band to the other when power is applied to it. When the band switch motor completes its travel, it turns itself off by one of two cam-operated switches. Diode CR404 and CR405 isolate the band switch motor from voltages of improper polarity. Band switch motor B401 also functions when the BAND switch is in the A or B (manual) position.

d. Since null switch transistor Q7001 is conducting, a groundpath is provided for the coils of relays K7101 and K9002. The other side of the coil of relay K9002 is connected to the +25.5-volt dc line and it energizes, thereby making 115-volt, 400-cps power available. The other side of the coil of relay K7101 connects to the +25.5-volt dc line through either diode CR7001 or CR7002 and switch S7103.

e. Diodes CR7001 and CR7002 isolate the band switch motor. Assume that the band switch motor ran counterclockwise and then turned itself off in its band A position. In so doing, it closed the cam-operated switch to its clockwise winding. If it were not for diode CR7002, +25.5 volts dc would be applied to the band switch motor clockwise winding and it would return to its band B position.

f. When relay K7102 energized, it performed two functions. It opened the charging path to the null switch capacitors and applied +25.5-volt dc power to switch S7103 and to the coil of relay K7101. It also connected the wiper of preset potentiometer R7101 to the servoamplifier input circuit (through servo gain potentiometer R304). When relay K7101 energized, it performed two functions. It removed +25.5-volt dc power available at contact 6 on keying relay K401 (thus preventing transmission) and supplied it to the servoamplifier and servo detent solenoid L301. When coil L301 is deenergized, it provides detent action for the gear train. Relay K7101 also switched 115-volt, 400-cps power from blower motor B6201 to servomotor-generator MG301 and transformer T301.

g. Potentiometer R7102 is the element in the servosystem which determines the new channel to which the RT-246/VRC will be tuned for the No. 1 preset channel. Potentiometers R7102 through R7110 determine the channels for preset channels No. 2 through 10. Potentiometer R7101 is connected in parallel with potentiometer R303. The wiper arm of potentiometer R303 is mechanically connected to the shaft of servomotor-generator MG301. Each potentiometer is, in effect, two resistances because of the wiper connections on them. These potentiometers (R303 and R7101) form a Wheatstone bridge.

h. Transformer T301 steps down the 115-volt, 400-cps power fed to it from the power supply to 24 volts. Capacitor C7101 supplements the harmonic filter in the power supply. The 24-volt power is connected through the phase-shift network to the Wheatstone bridge. The phase-shift network shifts the 400-cps voltage about 60°. An additional 30° phase shift occurs within the servoamplifier, thereby providing the 90° phase difference in the voltages applied to the fixed-phase and control-phase windings of the servomotor-generator. If the Wheatstone bridge is not balanced (which is the case when the RT-246/VRC is not turned to the channel determined by potentiometer R7101), a current will flow from the wiper arm of potentiometer R7101 to servoamplifier gain potentiometer R304. This error signal is taken from the wiper arm of potentiometer R304 and fed to the servoamplifier. The servoamplifier amplifies the error signal and supplies it as driving power to the servomotor-generator control phase winding. (Diode CR301 and capacitors C328 and C329 are part of the servoamplifier output circuit and are discussed in paragraph 19.)

i. Servomotor-generator MG301 runs and its rate generator portion produces an output signal. The phase output of the

rate generator is such that it causes the servomotor-generator to drive potentiometer R303 to bridge balance. A portion of the rate generator output is also fed to the servoamplifier input through potentiometer R304. This rate generator voltage provides electrical damping. Potentiometer R304 is normally adjusted for about a half-channel overshoot. The servomotor-generator is connected through the gear train to variable inductances in the receiver vhf tuner and the crystal reference system, and in the transmitter master oscillator, buffer, driver, and power amplifier stages. As the servomotor-generator runs, it tunes these components to the new channel. The servomotor-generator is also linked to switch S390 which selects different matching networks in the MX-2799/VRC (TM 11-5820-401-35, para 8).

j. For small tuning increments (where a new channel is less than five channels away from the present operating channel) the initial charge on capacitors C7001 and C7002 is sufficient to keep the null switch operating. In this case, the conducting time of null switch transistor Q7001 is determined by the resistance capacitance (rc) network consisting of resistor R7001 and capacitors C7001 and C7002. Bias for transistor Q7001 is provided by the voltage drop across diode CR7005. For larger tuning increments, the rate generator output filtered by capacitor C330 is fed to null switch input transformer T7001. The voltage appearing on the secondary winding of transformer T7001 is rectified by diode CR7003, thereby maintaining the charge on capacitors C7001 and C7002.

k. As the new channel is approached, the Wheatstone bridge approaches a balanced condition, decreasing the error signal input to the servo-amplifier. When the Wheatstone bridge is balanced, the null switch stops conducting, which opens the energizing circuits for relays K9002 and K7101. Relay K9002 removes input power to the power supply, thereby removing power from all 400-cps circuits. Relay K7101 removes +25.5-volt dc power from the servomotor-generator, the detent solenoid, and the servoamplifier. Relay K7102 remains energized until another pushbutton is pressed and the tuning cycle repeats.

l. If there is a loss of error signal, the servosystem drives to the mechanical limits of the tuning devices and damages them. Servo limit switch S303 opens the energizing path for relay K7101, stopping the servosystem before the tuning devices reach their mechanical limits. Diode CR302 provides arc suppression when power is removed from detent solenoid L301.

m. TUNE switch S7101 provides a goundpath for energizing relays K7101 and K9002. This switch is held closed when a new preset channel is being established. It is in effect, a manually operated equivalent of the null switch.

19. Servoamplifier Assembly A7200 in RT-246/VRC (fig. 13)

The servoamplifier consists of a three-stage, directly coupled, class A voltage amplifier and a push-pull power output stage. The servoamplifier has about an 8-watt power output.

a. First Voltage Amplifier Q7203. The input signal from the wiper arm of R304 is coupled to the base of transistor Q7203 through capacitor C7201. This signal is limited by resistor R7201 and the clipping action of diodes CR7201 and CR7202. Limitation of the input signal strength protects transistor Q7203. With no input signal, current drawn by the servoamplifier is determined by the voltage-divider network which consists of resistors R7202, R7204, and R7207. The voltage at the junction of resistors R7202, R7204, and R7207 is applied through resistor R7205 and determines the base voltage. The emitter-to-base bias is set by resistor R7208 and the dc resistance of inductor L7201. The collector output is developed across resistor R7206.

b. Second Voltage Amplifier Q7204. The output from the collector of transistor Q7203 is directly coupled to the base of emitter follower transistor Q7204, amplified, and directly coupled to the base of

transistor Q7205. Resistor R7209 is the emitter load for transistor Q7204 and also determines its base voltage. Capacitor C7205 prevents high-frequency oscillation.

c. Third Voltage Amplifier Q7205. Temperature-compensating bias for transistor Q7205 is provided by the voltage drop across diodes CR7203 and CR7204. Choke coil L7201 is the emitter load for transistor Q7205. The collector voltage is applied to the emitter of transistor Q7203 through resistor R7208 to provide dc feedback for bias stabilization of Q7203. Resistor R7203 and capacitors C7202 and C7203 are used for emitter degeneration to stabilize the stage. Resistors R7208 and R7207, and capacitor C7204 form an ac dividing network for degenerative feedback through resistor R7205 to the base of transistor Q7203. Capacitor C7207 prevents high-frequency oscillation.

d. Driver Amplifier Q7201 and Q7202. The output signal voltage from transistor Q7205 is coupled through capacitor C7206 to the primary winding of inverter transformer T7201. One end of the primary winding is connected to the secondary center-tap to provide a dc voltage reference level for capacitor C7206 and an arc ground for the winding. The center-tapped secondary winding of transformer T7201 feeds the push-pull emitter follower output stage consiting of transistors Q7201 and Q7202. The amplified output voltage is applied to the control phase winding of servomotor-generator MG301. Dc operating voltage is obtained at the center-tap of the control phase winding of servomotor-generator MG301. Temperature-compensating bias for transistors Q7201 and Q7202 is provided by the voltage drop across diode CR301. Capacitors C328 and C329 are transient suppressors.

20. Dc-to-Dc Converter (Assembly A9000) (fig. 14)

The dc-to-dc converter steps up the +25.5-volt dc input to the necessary high-voltage dc output to operate the transmitter driver and power amplifier, stages. The power supply will operate only when the transmitter is keyed.

a. The dc-to-dc converter consists of a power oscillator which operates at 2,000 cps, and three rectifier circuits.

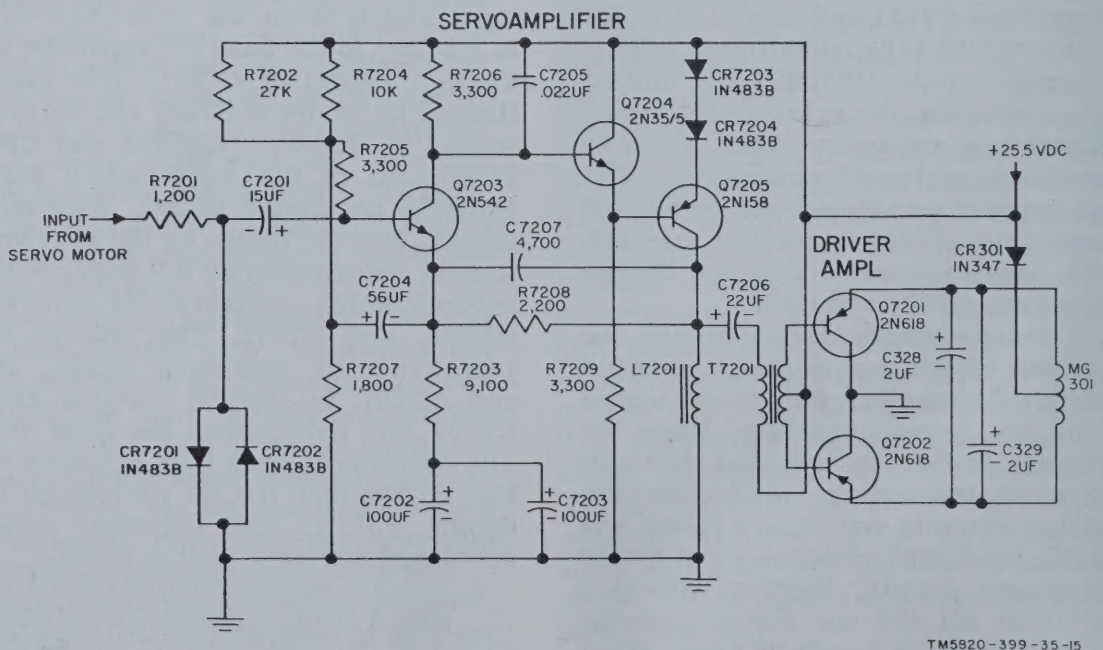


Figure 13. Servoamplifier assembly A7200, simplified schematic diagram.

Paralleled transistors Q9402 and Q9403, and Q9405 and Q9406 are connected in a common collector circuit to form the power oscillator. Center-tapped transformer T9001 provides the load for these transistors. Feedback is supplied by connecting the out-of-phase winding of transformer T9001 back to the bases of the transistors.

b. When relays K9001 and K9002 (fig. 67) are energized, +25.5-volt dc is applied to the dc-to-dc converter. Because of circuit unbalance, when power is first applied to the oscillator, a large current will flow through one pair of transistors and their associated portion of the primary winding of transformer T9001 (fig. 14) than will flow through the other. Assume that transistors Q9402 and Q9403 initially conduct more. Under this condition, the voltage induced in the feedback winding of transformer T9001 causes transistors Q9402 and Q9403 to conduct still more and to drive transistors Q9405 and Q9406 further into cutoff. The flux in the core of transformer T9001 changes at a nearly constant rate until the core is saturated. When the core becomes saturated, no voltage is developed in the feedback winding of transformer T9001. Feedback voltage decreases rapidly; driving current is removed from transistors Q9402 and Q9403 and the transistors are cut off.

c. When transistors Q9402 and Q9403 cut off, the flux in the core of transformer T9001 decreases slightly, and thus induces voltages of opposite polarity than previously existed in the winding of transformer T9001. This reverse of polarity drives transistors Q9402 and Q9403 further into cutoff and causes transistors Q9405 and Q9406 to conduct. The current again increases until the transformer core saturates; then the cycle repeats. For each half-cycle, transformer flux changes from saturation in one direction to saturation in the other. Transistors Q9402 and Q9403 and transistors Q9405 and Q9406 switch rapidly from cutoff to saturation, thus the current in transformer T9001 is essentially a square wave.

d. Since the emitters of transistors Q9402, Q9403, Q9405, and Q9406 are connected to the primary winding of transformer T9001, their emitter bias voltage is equal to the battery voltage minus the small voltage drop across diode CR9015. When the receiver transmitter is transmitting, the center-tap of the feedback winding of transformer T9001 is connected to the junction of resistors R9010 and R9012 through the contacts on relay K9001. This establishes a forward bias on the transistors. When the RT-246/VRC or the RT-524/VRC is not transmitting, contacts on relay K9001 short out half the feedback winding of transformer T9001 and connect it to the +25.5-volt dc source. This reverse-biases the transistors, which stops conduction and prevents oscillation. Diode CR9015 reverse-biases the transistors when the receiver-transmitter is not transmitting in order to prevent the transistors from destroying themselves. When the receiver-transmitter is transmitting, the effect of diode CR9015 on the circuit is negligible.

e. The alternating square wave that appears across each of the three secondary windings is rectified and filtered to furnish the transmitter driver and power amplifier stages with plate, screen, and bias voltages.

f. The 700-volt dc rectifier circuit (diodes CR9006 through CR9013) is a full-wave bridge rectifier, the output of which is filtered by capacitors C9003, C9004, and C9007. Resistors R9001, R9003, and R9004 are voltage equalizers and also act as bleeders to discharge the capacitors. This rectifier furnishes +700 volts dc to the power amplifier plate circuit. The voltage drop across resistor R9008 which may be monitored at test point TP9007 is proportional to the current drawn by the power amplifier plate.

g. The 275-volt rectifier circuit (diodes CR9002 through CR9005) forms a full-wave bridge rectifier, the output of which is filtered by capacitor C9005. Capacitor C9008 is an rf bypass capacitor. Resistor R9002 is a bleeder to discharge the capacitors. This rectifier furnishes +275 volts dc to operate the transmitter driver plate and screen grid circuits, as well

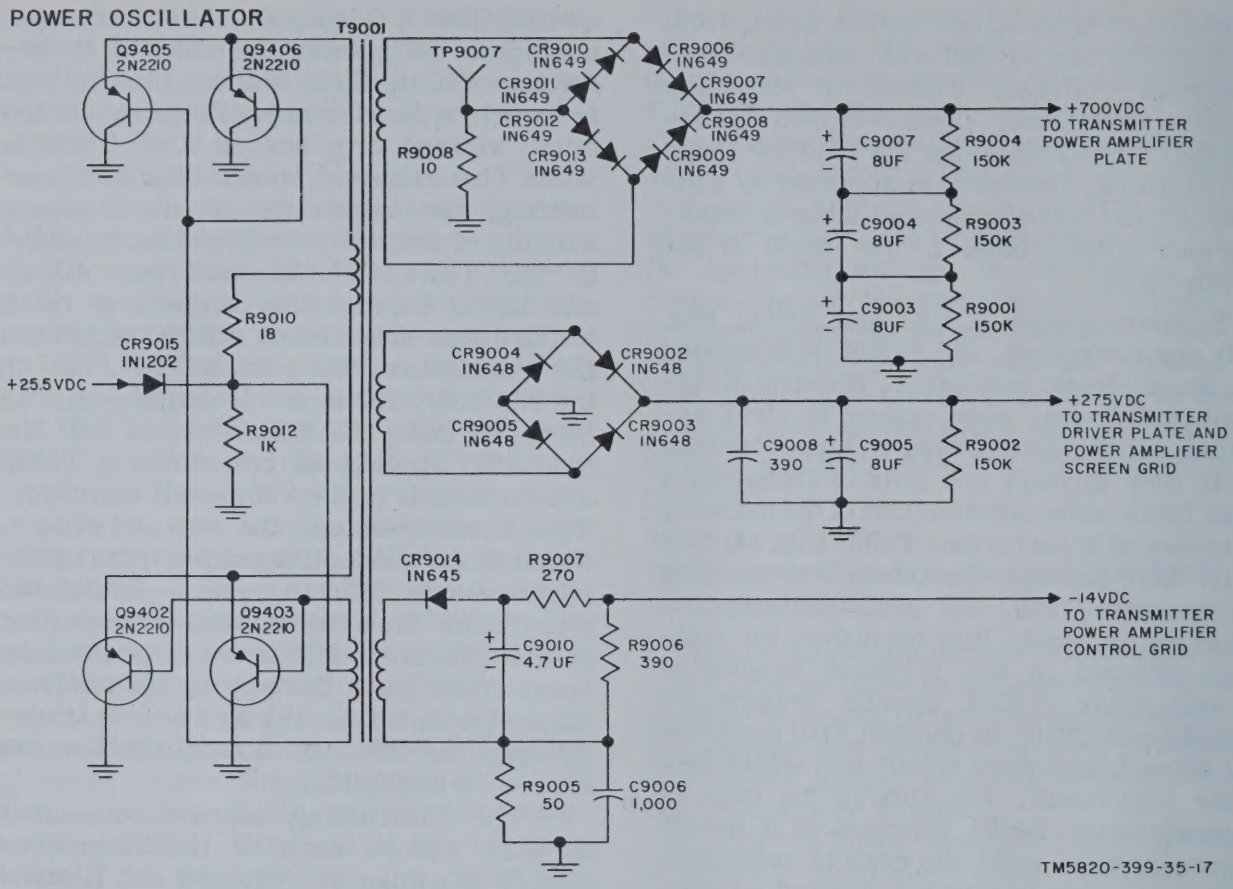


Figure 14. Dc-to-dc converter (assembly A9000), simplified schematic diagram.

as the power amplifier screen grid circuit.

h. Diode CR9014 is a half-wave rectifier, the output of which is filtered by capacitor C9010. The voltage divider consisting of resistors R9005, R9006, and R9007 develops a -14-volt dc level at the junction of resistors R9006 and R9007. Capacitor C9006 is an rf bypass capacitor. This rectifier is a fixed-bias supply and furnishes its -14 volts dc to the power amplifier control grid circuit.

21. Dc-to-Ac Converter (fig. 15)

The dc-to-ac converter changes the +25.5-volt dc input voltage to 115 volts 400 cps ac for the operation of the transmitter blower motor and the servosystem. The blower motor will operate only when the transmitter is keyed.

a. The dc-to-ac converter consists of a power oscillator assembly which operates at 400 cps and a filtered step-up transformer circuit. Transistors Q9401 and Q9404 are connected in a common emitter circuit to form the power oscillator. Center-tapped transformer T9002 provides the load for these transistors. Feedback is supplied by connecting the out-of-phase winding of transformer T9002 back to the bases of the transistors.

b. The operation of this power oscillator is similar to the one described in paragraph 20 except that its frequency is 400 cps and, because of a lower current demand, the paralleling of transistors is not required. Transistors Q9401 and Q9404 are forward-biased by resistors R9009 and R9011. Capacitors C9011 and C9012, connected across the primary winding of transformer T9002, are transient suppressors. Resistors R9401

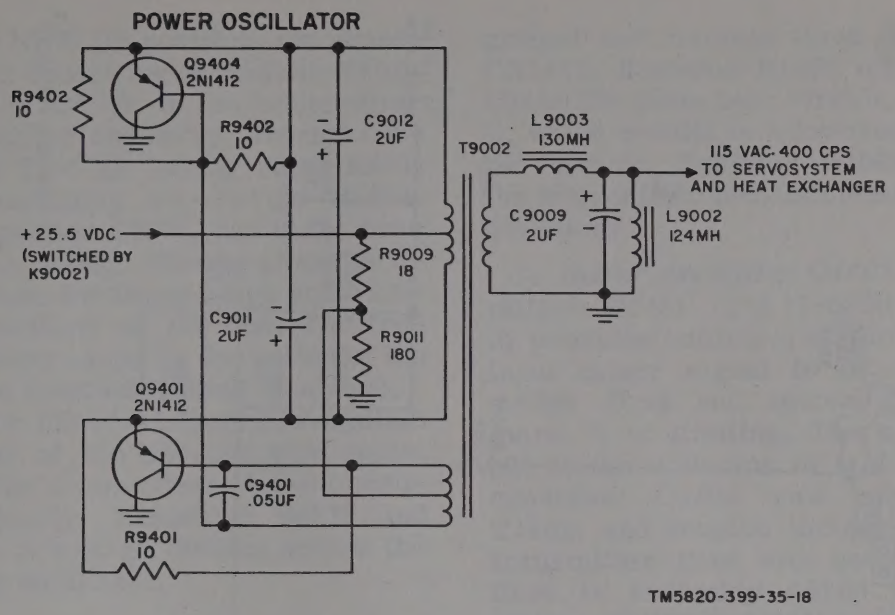


Figure 15. Dc-to-ac converter (assembly A9000), simplified schematic diagram.

and R9402, and capacitor C9401 form a spike-suppression network.

c. When relay K9002 is deenergized, +25.5-volt dc is removed from the power oscillator, and the oscillator is therefore inoperative.

d. Capacitor C9009 and coils L9002 and L9003 form a harmonic filter for the 400-cps voltage appearing across the secondary of transformer T9002. The 115-volt, 400-cps output of the secondary circuit is applied to the blower motor and/or the servosystem.

22. Squelch Tone Oscillator, 150-Cps (fig. 16)

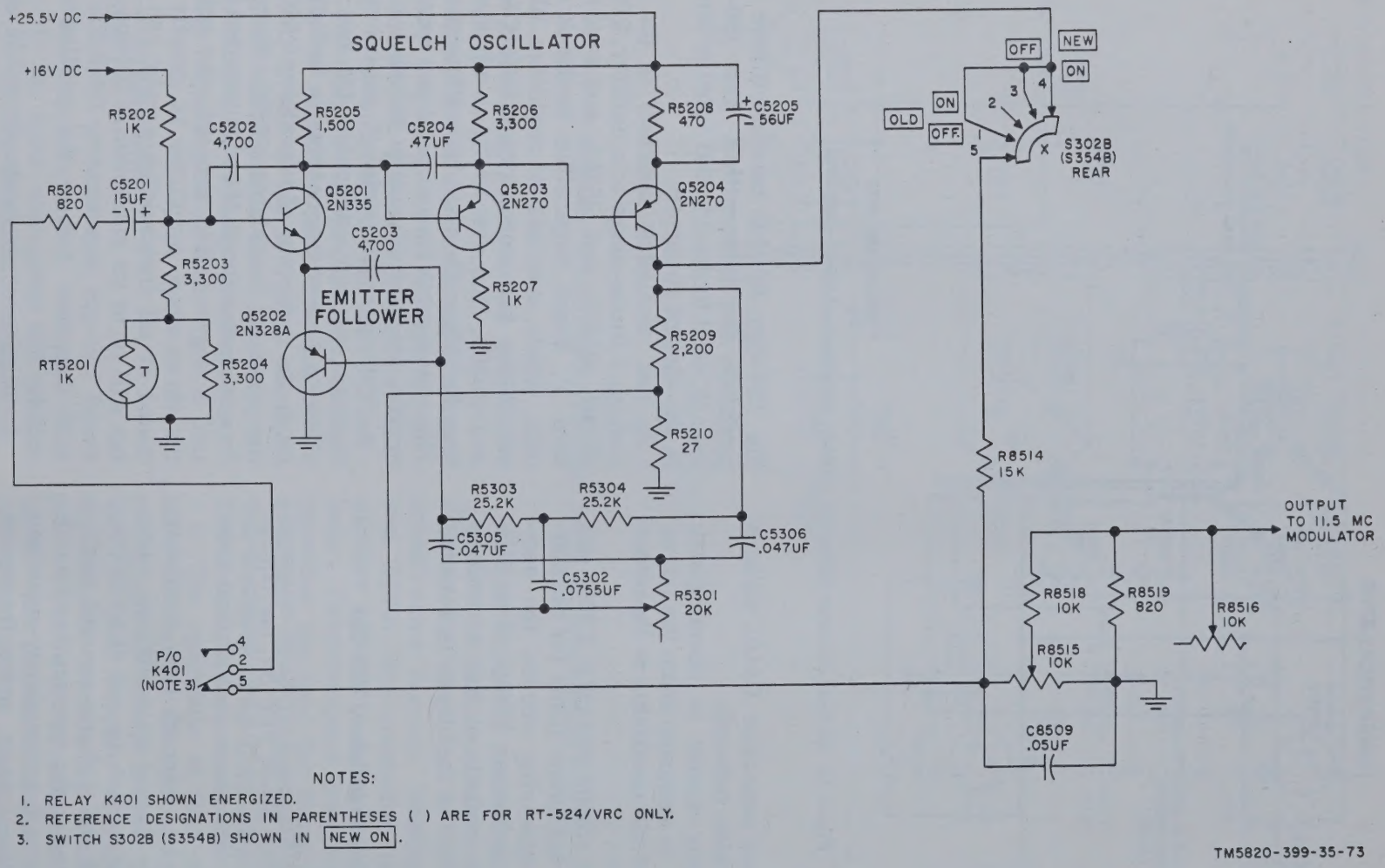
Note: With the front panel SQUELCH switch set at any position except NEW ON, the 150-cps squelch tone oscillator will act as a squelch ac amplifier. For circuit details, see TM 11-5820-409-35, paragraph 19.

a. The 150-cps squelch tone oscillator functions only during transmission, when the SQUELCH switch is set at NEW ON. The output of the 150-cps squelch oscillator is applied to the transmitter speech amplifier (para 7) to frequency-modulate the transmitter. When voice frequency signals are applied to the transmitter speech amplifier, both the voice frequency signal and the 150-cps tone from the 150-cps squelch tone oscillator will modulate the transmitter. The 150-cps tone is used to disable the squelch circuit in the distant receiver.

b. The oscillator consists of the following: a three-stage ac amplifier, Q5201, Q5202, Q5203, and Q5204; and a parallel twin T, tuned degerative feedback circuit, which consists of resistors R5303 and R5304 and capacitors C5302, C5305, and C5306. Rheostat R5301 is adjusted to tune the filter for maximum attenuation to 150-cps squelch tone signals and a regenerative feedback circuit (*d* below).

c. The parallel twin T degenerative feedback circuit attenuates 150 cps, but allows all other frequencies to be fed back from the collector of transistor Q5204 to the base of transistor Q5202. Since all frequencies except 150 cps are fed back into a degenerative network, the gain of the three-stage amplifier is greatly reduced at all frequencies except 150 cps, but will be at its maximum at 150 cps. The tuned 150-cps degenerative feedback circuit therefore tunes the oscillator to exactly 150 cps.

d. Regenerative feedback at 150 cps is applied from the collector of transistor Q5204, through the main-frame wiring and connectors, through the SQUELCH switch



NOTES:

1. RELAY K401 SHOWN ENERGIZED.
2. REFERENCE DESIGNATIONS IN PARENTHESES ( ) ARE FOR RT-524/VRC ONLY.
3. SWITCH S302B (S354B) SHOWN IN NEW ON.

TM5820-399-35-73

Figure 16. Squelch tone oscillator, 150-cps, simplified schematic diagram.

when in the NEW ON position, the phase-shift network consisting of resistor R8514 and capacitor C8509 in the transmitter speech amplifier assembly, through contacts 2 and 5 of the keying relay K401, impedance-matching resistor R5201, coupling capacitor C5201, and to the base of transistor Q5201. This in-phase feedback will cause the three-stage audio amplifier to oscillate at 150 cps. The frequency is determined by the action of the degenerative feedback circuit (*a* above).

e. Resistor R8515 is adjusted to regulate the strength of the 150-cps tone signal applied to the transmitter 11.5-mc modulator assembly. Resistors R8518 and R8519 form a voltage divider across the output of the oscillator.

23. Common Receiver-Transmitter Circuits

Note: During transmit operation of the receiver-transmitters, some circuits of the receiver section are used in conjunction with the transmitter.

a. Receiver Mixer V1401. The receiver mixer (TM 11-5820-409-35, fig. 5) heterodynes the receiver local oscillator output with the transmitter oscillator-buffer amplifier output (para 12) to produce an 11.5-mc if. output. The input from the transmitter oscillator-buffer amplifier is applied through isolating resistor R1004 to the control grid, pin 1, of V1004. The mixer output is coupled through capacitors C1407 and C1408 to the emitter of buffer amplifier Q1401. The switched 105-volt dc supply line is connected to ground and current flows through diode CR1401. Resistor R1402 effectively parallels the plate tank circuit, lowering the Q, which results in a lowered output from the circuit. Resistor R1005 terminates the transmitter oscillator-buffer output to the mixer.

b. Buffer Amplifier Q1401. Buffer amplifier Q1401 (TM 11-5820-409-35, fig. 5) provides sufficient amplification of the input mixer signal to drive the transmitter first and second if. amplifiers (para 9) to limiting. The amplified output at the collector of Q1401 is tuned by capacitor C1409 and autotransformer T1402, and coupled through C1410 to the transmitter first and second if. amplifiers in assembly A8300 (para 9). Resistors R1409 and R1407 set the emitter-to-base bias. Resistor R1405 determines the collector voltage. Capacitor C1402 is an rf bypass capacitor. Inductor L1401 and capacitor C1405 form a decoupling network on the 16-volt dc line.

c. Hunt Cutoff Detector. The rectifying circuit (TM 11-5820-409-35, fig. 11), consisting of diode CR4201, load resistor R4209, and bypass capacitor C4212, furnishes a dc voltage to bias off the relaxation oscillator in the transmitter hunt generator (para 17) when the proper transmitter operating frequency has been reached. Resistor R4222 is a bleeder for capacitor C401 in the transmitter hunt generator cutoff time-delay network.

CHAPTER 3

THIRD ECHELON MAINTENANCE

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warning: **Be extremely careful when servicing the receiver-transmitter. During transmission, high voltages of 700 volts dc and 275 volts ac exist in assemblies A9000, A6100, and A6200.**

24. Scope of Third Echelon Maintenance

The field and depot maintenance procedures in this manual *supplement* the procedures described in TM 11-5820-401-10 and TM 11-5820-409-35. The systematic troubleshooting procedure, which begins with the operational and equipment performance checks that can be performed at organizational level, is carried to a higher level in this chapter. Paragraphs 27 through 30 provide the troubleshooting procedures to be performed by third echelon maintenance personnel, paragraphs 31 through 38 describe third echelon maintenance repair procedures, and paragraphs 39 through 42 give instructions for aligning the servosystem, the driver, and the power amplifier of the receiver-transmitter after it has been repaired.

25. Organization of Third Echelon Troubleshooting Procedures

a. General. The first step in servicing a defective receiver-transmitter is to sectionalize the fault. Sectionalization means tracing the fault to a major component such as the power supply, the heat exchanger assembly, or the case wiring. The second step is to localize the fault. Localization means tracing the fault to a defective assembly or area. The third step is to isolate the faulty parts. Isolation means tracing the fault to certain parts or to a circuit board within an assembly. Some faults, such as burned-out resistors and arcing and shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be isolated by checking voltages and continuity.

b. Sectionalization. Listed below is a group of tests arranged to reduce unnecessary work and to aid in tracing trouble in a defective receiver-transmitter. The RT-246/VRC consists of 17 major assemblies: the case, the front panel, and assemblies A1000, A2000, A2100, A3000, A4000, A5000, A6000, A6100, A6200, A7000, A7100, A7200, A8000, A9000, and A9400. The RT-524/VRC includes all of these major assemblies except assemblies A7000, A7100, and A7200. Third echelon troubleshooting and repair procedures for assemblies A1000, A2000, A3000, A4000, and A5000 are contained in TM 11-5820-409-35. The first step is to sectionalize the trouble to units at fault by following the procedures listed in (1) and (2) below.

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring the circuits. All visual signs should be observed and an attempt made to sectionalize the fault to a particular assembly or area.

(2) *Operational tests.* Operational tests frequently indicate the general location of a trouble. In many instances, the tests will help in determining the exact nature of the fault. Use the equipment performance checklist (TM 11-5820-401-20).

c. Localization and Isolation. The procedures given in (1) through (3) below will aid in localizing and isolating the trouble. First localize the trouble to an assembly or area, and then isolate the trouble to the defective part or to a circuit board within an assembly. Use the following methods:

(1) *Troubleshooting chart.* The trouble

symptoms listed in the troubleshooting chart (para 28*b*) will aid in localizing and isolating trouble to a component part or assembly.

(2) *Voltage and continuity measurements.* The receiver-transmitter is transistorized. Observe all cautions given to prevent transistor damage. Make voltage and continuity measurements in the receiver-transmitter *only as specified.* When measuring voltages, use tape or sleeving to insulate the entire test prod, except the extreme tip. A momentary short circuit can ruin a transistor. (For example, if the bias is shorted out, excessive current between the emitter and the base will ruin the transistor.

(3) *Intermittent troubles.* In all these tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the RT-246/VRC or the RT-524/VRC. Check the wiring, the connections, and the plug and jacks of major assemblies of the receiver-transmitter.

26. Test Equipment and Additional Equipment Required

The following charts list the test equipment, the associated technical manuals, and the additional equipment required for troubleshooting the receiver-transmitter.

a. Test Equipment.

Test equipment	Technical manual
Power Supply PP-1104A/G or equivalent	TM 11-5126
Multimeter ME-26B/U or equivalent	TM 11-6625-200-12
Radio Frequency Wattmeter AN/URM-43	TM 11-5133
Multimeter TS-352/U or equivalent	TM 11-5527

b. Additional Equipment.

Equipment	Technical manual
Test cable No. 1	(fig. 28)
Test cables No. 2 through 5.	TM 11-5820-409-35 (fig. 54 and 55)
Test cables No. 6 through 8.	(fig. 45)
Antenna AT-912/VRC	TM 11-5820-401-20
Receiver, Radio R-442/VRC or equivalent	TM 11-5820-401-10

Section II. THIRD ECHELON TROUBLESHOOTING

Caution: **Do not attempt removal or replacement of parts before reading the instructions in paragraph 31.**

27. Test Setup

a. Preparatory Steps. To prepare the receiver-transmitter for bench testing and voltage and resistance measurements, proceed as follows:

(1) Remove it from the MT-1029/VRC.

(2) Remove its top and bottom covers.

b. Power Supply PP-1104A/G. Connect Power Supply PP-1104A/G to the receiver-transmitter; use test cable No. 1.

c. Test Equipment. Use the ME-26B/U, or equivalent, for making voltage, resistance and continuity tests. When making measurements, sharpen the test probe tip to puncture the epoxy coatings in assemblies A6000, A7000, A7200, and parts of A9000.

d. Additional Equipment. Connect an AT-912/VRC to the receiver-transmitter (TM 11-5820-401-20). Set up a Receiver, Radio R-442/VRC or a receiver-transmitter, to monitor the signal transmitted by the receiver-transmitter (TM 11-5820-401-20). Use the test cables (para 26) as appropriate.

e. Control Settings. Start the troubleshooting procedures with the RT-246/VRC

or the RT-524/VRC controls set as follows:

Control	Position
POWER switch	HIGH
LIGHT switch	ON
SQUELCH switch	OLD OFF
BAND switch	A

28. Test Conditions and Use of Troubleshooting Charts

a. Test Conditions. All voltage checks outlined in the troubleshooting charts are to be conducted with the RT-246/VRC or the RT-524/VRC connected to the power source and the additional equipment (para 27). Turn off the PP-1104A/G, or equivalent, before making resistance tests.

b. Troubleshooting Charts. Use the troubleshooting charts in *c* and *d* below as a *supplement* to the appropriate operational checklist (TM 11-5820-401-10) and the equipment performance checklist (TM 11-5820-401-20). The troubleshooting charts in *c* and *d* below pertain only to the transmitter portions of the RT-246/VRC and the RT-524/VRC. Use the Receiver, Radio R-442/VRC troubleshooting charts (TM 11-5820-409-35) for the receiver portions of the RT-246/VRC and the RT-524/VRC.

c. Troubleshooting Chart for Receiver-Transmitter, Radio RT-246/VRC.

Item	Indication	Probable trouble	Procedure
1	Dial lamp does not light. No output from receiver-transmitter.	Switch S304 or S308 defective --	Remove front panel (para 32). Check S304 and S308 (fig. 17).
		Diode CR411 defective --------	Check CR411 (fig. 20).
		Circuit breaker CB302 defective	Check CB302 (fig. 17).
		Connectors P401, J402, and/or P302.	Check P401, J402, and/or P302 (fig. 17 and 19).
		Defective front panel and case cabling.	Check front panel and case cabling (fig. 71 and 72).
2	POWER switch moves to OFF after being turned to HIGH (BAND at A or B).	*a.* Zener diode CR412 shorted	*a.* Check CR412 (fig. 20). Low forward and reverse resistance indicates defective CR412.
		b. Power-supply transistors shorted.	*b.* Higher echelon repair required.
		c. Short circuit between +25.5-volt dc line and ground.	*c.* Remove power-supply assembly A9000 (TM 11-5820-401-20, para 17*e*). Turn POWER switch to HIGH; if it stays at HIGH, install new A9000; if it moves to OFF again, proceed to *d* below. *d.* Remove heat exchanger (para 34). Turn POWER switch to HIGH; if it stays at HIGH, check assemblies A6100 and/or A6200 (para 29 and 30). *e.* Disconnect each of the items below, as required. After each disconnection, turn POWER switch to HIGH. If POWER switch stays at HIGH after disconnection, trouble is in item last disconnected. (1) Brown color-coded plug on A1000 (fig. 18). (2) P3001 (fig. 18). (3) P4001 (fig. 18). (4) Remove A5000 (TM 11-5820-401-20 para 17*d*). (5) A2100-5 and A2100-6 (disconnects Q403) (fig. 20). (6) A2100-1 through A2100-4 and A2100-7 through A2100-9 (TM 11-5820-401-20, fig. 24). *f.* If POWER switch still moves to OFF after performing procedures in *a* through *e* above, check front panel and case cabling (fig. 71 and 72).

Item	Indication	Probable trouble	Procedure
3	POWER switch moves to OFF after being turned to HIGH (BAND switch at AUTO).	Diode CR302 shorted	Check CR302 (para 33*h*).
4	Blower motor does not run when RT-246/VRC is transmitting.	Blower motor B6201 defective	Check blower motor B6201 by substitution (para 34*b*).
		Capacitor C6202 defective	Check C6202 by substitution (fig. 25).
		Low 115-volt ac output from assembly A9000.	Check voltage at test point TP9003 (TM 11-5820-401-20, fig. 20). Normal indication is 108 to 116-volt ac. If indication is abnormal, replace A9000 (TM 11-5820-401-20 para 17*e*).
5	RT-246/VRC rf output signal received on wrong channel.	No +25.5-volt dc input power to assembly A8000.	Check at TP8001 (TM 11-5820-401-20, fig. 20) and at terminal 1 of connector P8001 (fig. 20) for +25.5 volts dc. If present at P8001 but not at TP8001, replace A8000 main circuit board (para 37). If not present at P8001, check case cabling continuity (fig. 71).
		Assembly A6300 defective	Check A6300 by substitution (para 38).
		Assembly A6400 defective	Check A6400 by substitution (para 38).
		Variable coils in assembly A6000 defective.	Tune R-442/VRC to 45.00 mc. Tune RT-246/VRC to 30.00 mc, and then to 45.00 mc. Note channel on which signal is received. Tune RT-246/VRC to 52.95 mc, and then back to 45.00 mc. If signal is not received on same channel, replace A6000 (para 32 and 33*f*).
6	RT-246/VRC output signal is received on several channels.	Hunt cutoff detector circuit defective.	Check diode CR413 (fig. 20) and capacitor C401 (fig. 19). Check hunt cutoff detector circuit components (TM 11-5820-409-35, fig. 93).
7	Low rf power output	Poor alignment of assemblies A6100 and A6200.	Check alignment (para 41 and 42).
		Assembly A6400 defective	Check assembly A6400 by substitution (para 38).
		Low power-supply output voltages.	Check power-supply A9000 by substitution (TM 11-5820-401-35, para 17*e*).
		Variable coils in assemblies A6100 and/or A6200 defective.	Higher echelon repair required.
		Output tank circuit defective	Higher echelon repair required.
8	No rf power output	Assembly A6300 defective	Check assembly A6300 by substitution (para 38).
		Assembly A6400 defective	Check assembly A6400 by substitution (para 38).
		Assembly A6000 defective	Check assembly A6000 by substitution (para 32 and 33*f*).
		Keying relay K401 circuits defective (case cabling).	Check continuity through keying relay K401 circuits (fig. 69).
		Defective components in assemblies A6100 and/or A6200.	Check assemblies A6100 and/or A6200 (para 29 and 30).
9	RT-246/VRC will not change from band A to band B channel during manual tuning.	Diode CR405 open	Check diode CR405 (fig. 20).
		Band switch motor B401 defective.	Replace band switch motor B401 (para 35a).
10	RT-246/VRC will not change from band B to band A channel during manual tuning.	Diode CR404 open	Check diode CR404 (fig. 20).
		Band switch motor B401 defective.	Check band switch motor B401 by substitution (para 35a).
11	RT-246/VRC will not change from band A channel to band B channel or from band B channel to band A	Band selector switches in assembly A7100 defective.	Check assembly A7100 by substitution (para 33*d*).

Item	Indication	Probable trouble	Procedure
	channel (BAND switch in AUTO).		
12	With BAND switch at AUTO, servosystem hums but will not run.	Detent solenoid L301 open ----	Check detent solenoid L301 by substitution (para 33a).
13	With BAND switch at AUTO, servosystem runs to high or low limit and RT-246/VRC cannot be tuned to low or high channel.	Potentiometer R304 improperly adjusted.	Realign servosystem (para 40).
		One or more diodes (CR7101 through CR7110) in assembly A7100 shorted.	Check assembly A7100 by substitution (para 33*d*).
14	With BAND switch at AUTO, RT-246/VRC cannot be tuned to any preset channel.	Assembly A7200 defective ----	Check assembly A7200 by substitution (para 33*e*).
		Servomotor-generator MG301 defective.	Replace servomotor-generator MG301 (para 33*k*).
		Potentiometers R303 and/or R304 defective.	Check by substitution potentiometers R303 (para 33*f*) and/or R304 (para 33*g*).
		Transformer T301 defective --	Check transformer T301 by substitution (fig. 18).
		Phase-shift network Z301 defective.	Check phase-shift network Z301 by substitution (fig. 17).
		Pushbutton switches in assembly A7100 defective.	Check assembly A7100 by substitution (para 33*d*(2)).
		One or more potentiometers (R7101 through R7110) in assembly A7100 defective.	Check assembly A7100 by substitution (para 33*d*(2)).

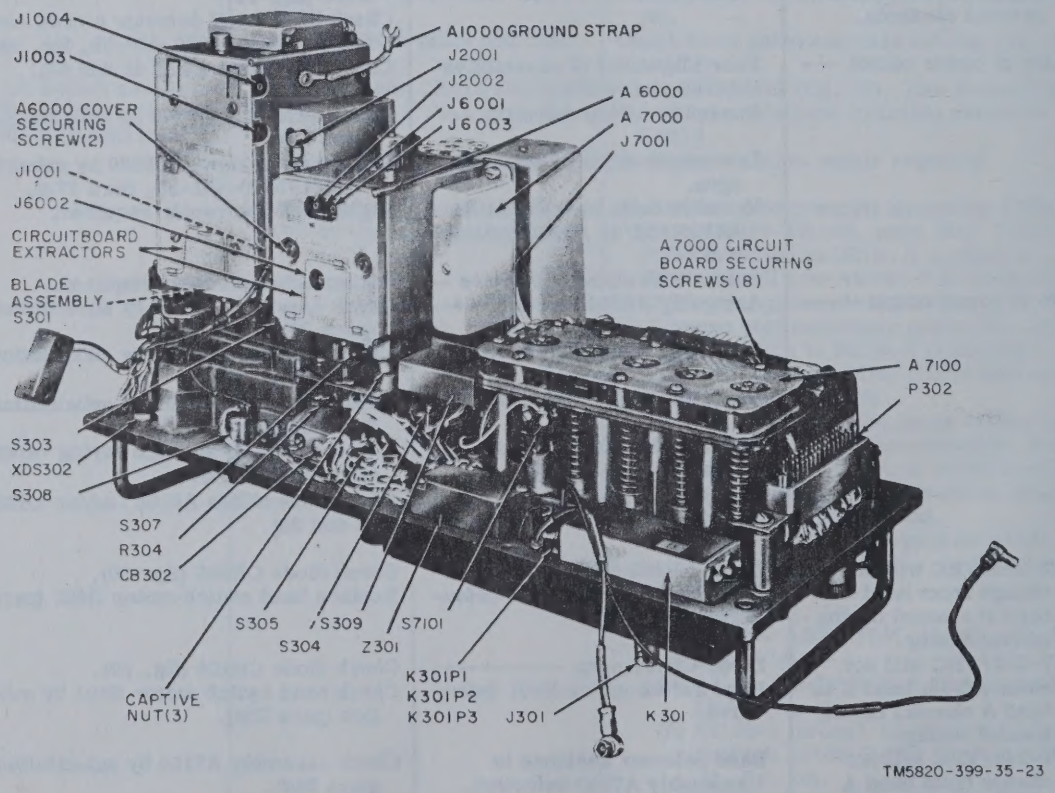


Figure 17. Receiver-Transmitter, Radio RT-246/VRC, front-panel assembly, top view.

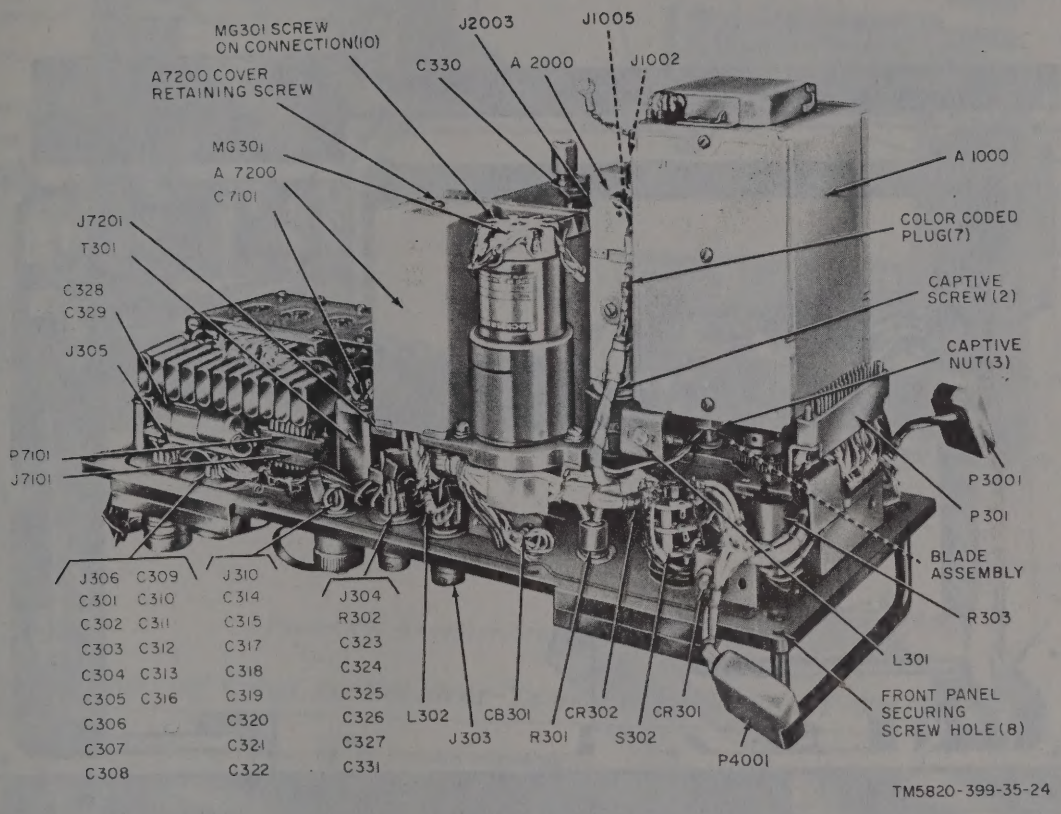


Figure 18. Receiver-Transmitter, Radio RT-246/VRC, front-panel assembly, bottom view.

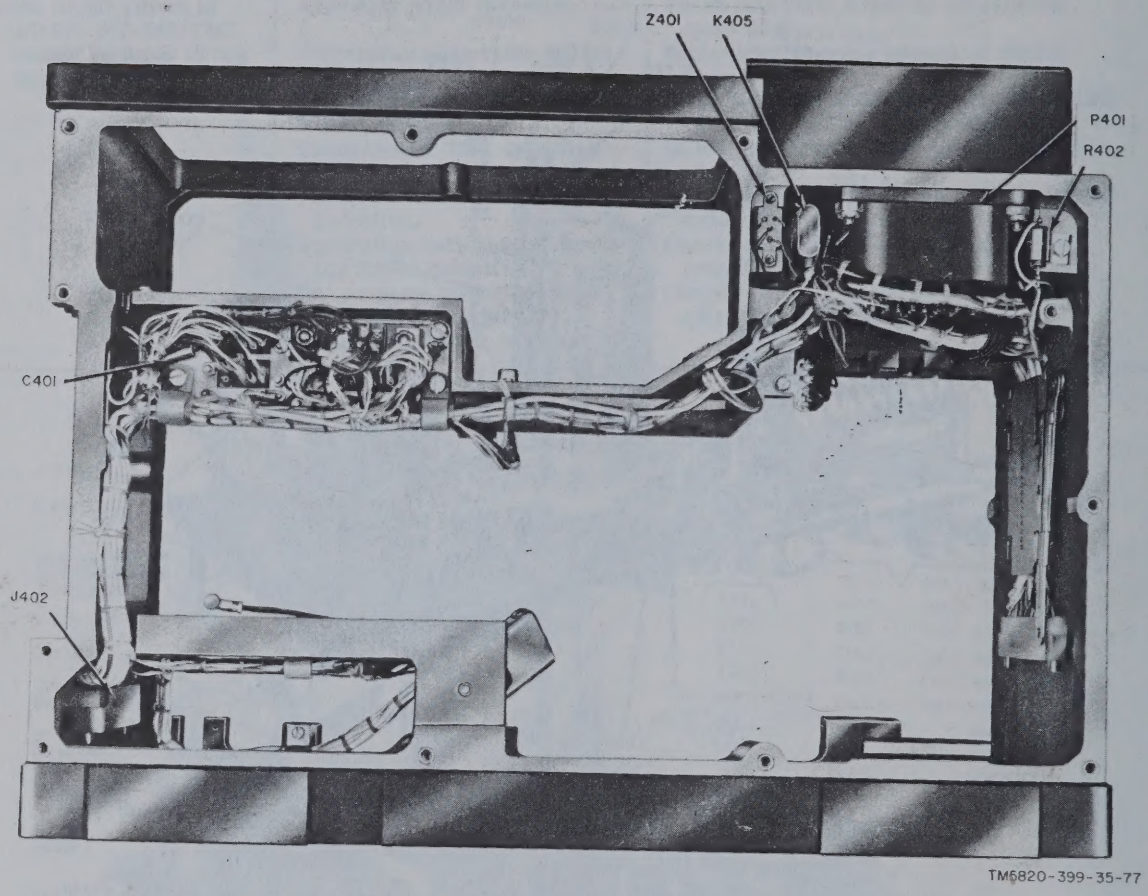


Figure 19. Receiver-Transmitter case, bottom view.

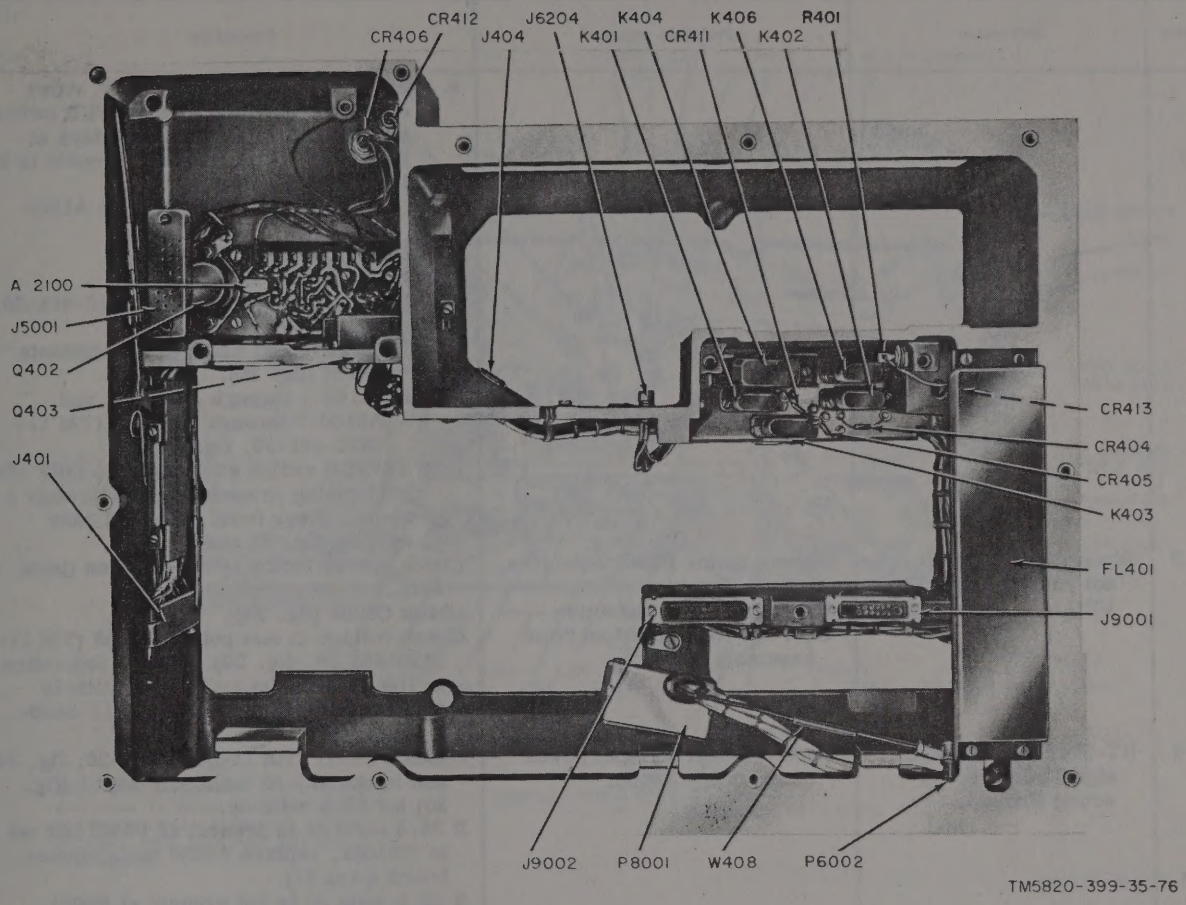


Figure 20. Receiver-Transmitter case, top view.

d. Troubleshooting Chart for Receiver-Transmitter, Radio RT-524/VRC.

Item	Indication	Probable trouble	Procedure
1	Dial lamp does not light	----------	Remove front panel (para 32).
		Switch S353 defective --------	Check switch S353 (fig. 21).
		Diode CR411 defective -------	Check CR411 (fig. 20).
		Circuit breaker CB352 defective.	Check circuit breaker CB352 (fig. 21).
		Switch S352 defective --------	Check S352 (fig. 21).
		Connectors P401, J402, and/or P351 defective.	Check P401, J402, and/or P351 (fig. 19 and 21) for continuity.
		Defective front panel and case cabling.	Check front panel and case cabling for continuity (fig. 71 and 73).
2	POWER switch moves to OFF after being turned to HIGH (BAND switch at A or B).	Zener diode CR412 shorted ---	*a.* Check CR412 (fig. 20).
		Power-supply transistors defective.	*b.* Higher echelon repair required.
		Short circuit between +25.5-volt dc line and ground.	*c.* Remove power-supply assembly A9000 (TM 11-5820-401-20, para 17*e*). Turn POWER switch to HIGH; if it stays at HIGH, install new A9000. If it moves to OFF again, proceed to step *d* below.
			d. Remove heat exchanger (para 34). Turn POWER switch to HIGH; if it stays at HIGH, check assemblies A6100 and A6200 (para 29 and 30).

Item	Indication	Probable trouble	Procedure
			e. Make the disconnections below. After each disconnection turn POWER switch to HIGH. If POWER switch stays at HIGH after disconnection, trouble is in item last disconnected. (1) Brown color-coded plug on A1000 (fig 21). (2) P3001 (fig. 21) of A3000. (3) P4001 (fig. 21) of A4000. (4) Remove A5000 (TM 11-5820-401-20, para 17*d*). (5) A2100-5 and A2100-6 (disconnects Q403) (fig. 20). (6) A2100-1 through A2100-4, and A2100-7 through A2100-9 (TM 11-5820-401-20, fig. 24). *f.* If POWER switch still moves to OFF after performing procedures in *a* through *e* above, check front panel and case cabling (fig. 71 and 73).
3	Blower motor B6201 does not run when RT-524/VRC is transmitting.	Blower motor B6201 defective	Check blower motor by substitution (para 34*b*).
		Capacitor C6202 defective --->	Check C6202 (fig. 25).
		LOW 115-volt ac output from assembly A9000.	Check voltage at test point TP9003 (TM 11-5820-401-20, fig. 20). Normal indication is 108 to 116 volts ac. If indication is abnormal, replace A9000 (TM 11-5820-401-20, para 17*e*).
4	RT-524/VRC rf output signal received on wrong channel.	No +25.5-volt dc input power to assembly A8000.	Check TP8001 (TM 11-5820-401-20, fig. 20) and terminal 1 of connector P8001 (fig. 20) for 25.5 volts dc. If 25.5 volts dc is present at P8001 but not at TP8001, replace A8000 main circuit board (para 37). If 25.5 volts dc is not present at P8001, check case cabling continuity (fig. 71).
		Assembly A6300 defective ----	Check A6300 by substitution (para 38).
		Assembly A6400 defective ----	Check A6400 by substitution (para 38).
		Variable coils in assembly A6000 defective.	Tune R-442/VRC to 45.00 mc. Tune RT-524/VRC to 30.00 mc, and then to 45.00 mc. Note channel on which signal is received. Tune RT-524/VRC to 52.95 mc, and then back to 45.00 mc. If signal is not received on same channel, replace A6000 (para 32 and 33*f*).
5	RT-524/VRC output signal is received on several channels.	Hunt cutoff detector circuit defective.	Check diode CR413 (fig. 20) and capacitor C401 (fig. 19). Check hunt cutoff detector circuit components (TM 11-5820-409-35, fig. 93).
6	Low rf power output ---	Poor alignment ----------	Check alignment (para 41 and 42).
		Assembly A6400 defective ----	Check A6400 by substitution (para 38).
		Low power-supply output voltages.	Check power-supply assembly A9000 by substitution (TM 11-5820-401-35, para 17*e*).
		Variable coils in assembly A6100 or A6200 defective.	Higher echelon repair required.
		Output tank circuit coupling defective.	Higher echelon repair required.
7	No rf power output-----	Assembly A6300 defective ----	Check A6300 by substitution (para 38).
		Assembly A6400 defective ----	Check A6400 by substitution (para 38).
		Assembly A6000 defective ----	Check assembly A6000 by substitution (para 32 and 33*f*).
		Power-supply assembly A9000 defective.	Check power-supply assembly A9000 by substitution (TM 11-5820-401-20, para 17*e*).
		Keying relay K401 circuits defective (case cabling).	Check continuity through keying relay K401 circuits (fig. 70).
		Defective components in assemblies A6100 and/or A6200.	Check assemblies A6100 and A6200 (para 29 and 30).

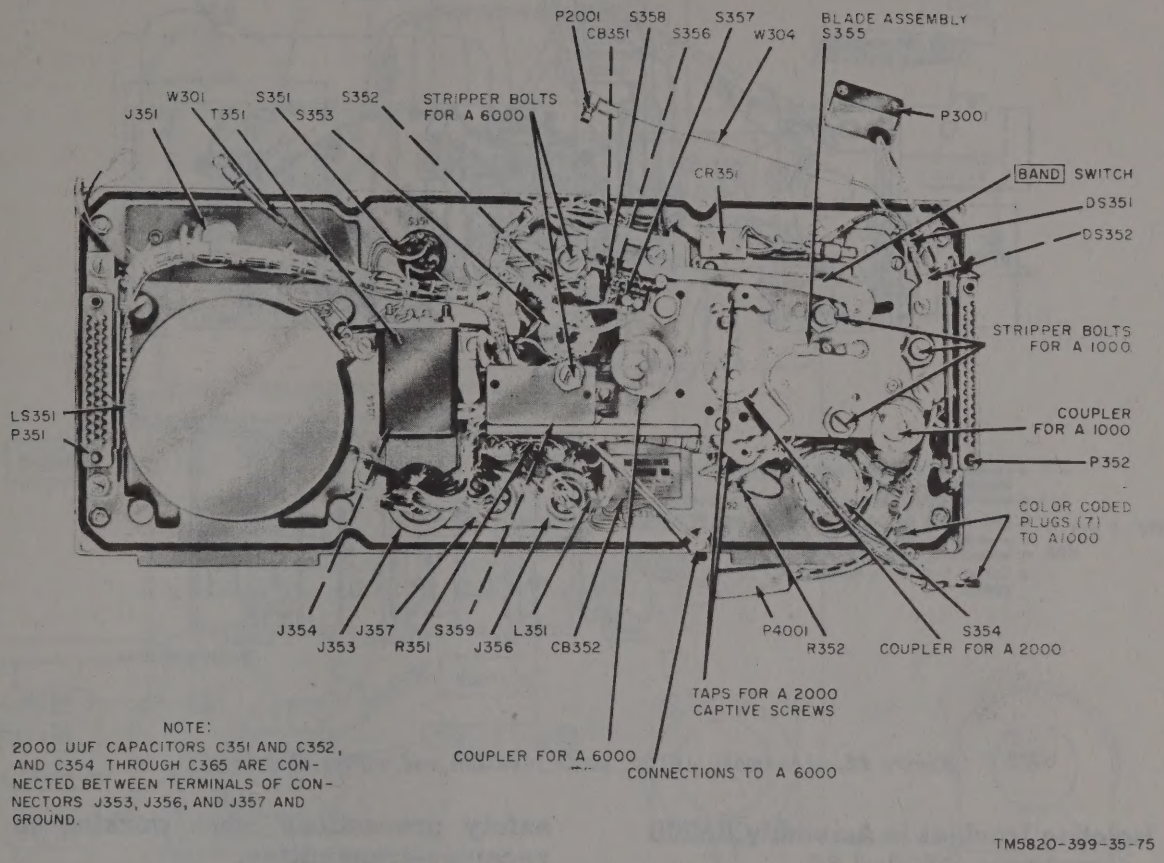


Figure 21. Receiver-Transmitter, Radio RT-524/VRC, front panel assembly, rear view, assemblies A1000, A2000, A6000, and K301 removed.

29. Isolating Troubles in Assembly A6100 (fig. 22 and 66)

When trouble has been localized to assembly A6100, use the following techniques to isolate the defective part:

a. Test tube V6101, either in a tube tester or by substituting a new tube.

b. Remove V6101 (TM 11-5820-401-20, para 14*a*) and take voltage measurements at the tube socket (chart below) with the POWER switch in the HIGH position and the transmitter keyed.

Warning: **When the receiver-transmitter is transmitting, contacts on its power supply and power amplifier tube are at a potential of +700 volts dc. Observe all safety precautions when working on the receiver-transmitter.**

c. If the voltage readings are abnormal, to isolate open and short circuits, take resistance readings (chart below) with the POWER switch in the OFF position. Make all measurements between the indicated pin of socket XV6101 and ground.

Socket XV6101 voltage and resistance chart

Pin	Dc volts	Ohms
1	0	220
2	0	4,700
3	0	220
4	+6.3	Greater than 0 but less than 50
5	0	0
6	+275	Infinity
7	+275	Infinity
8	0	220
9	+275	Infinity

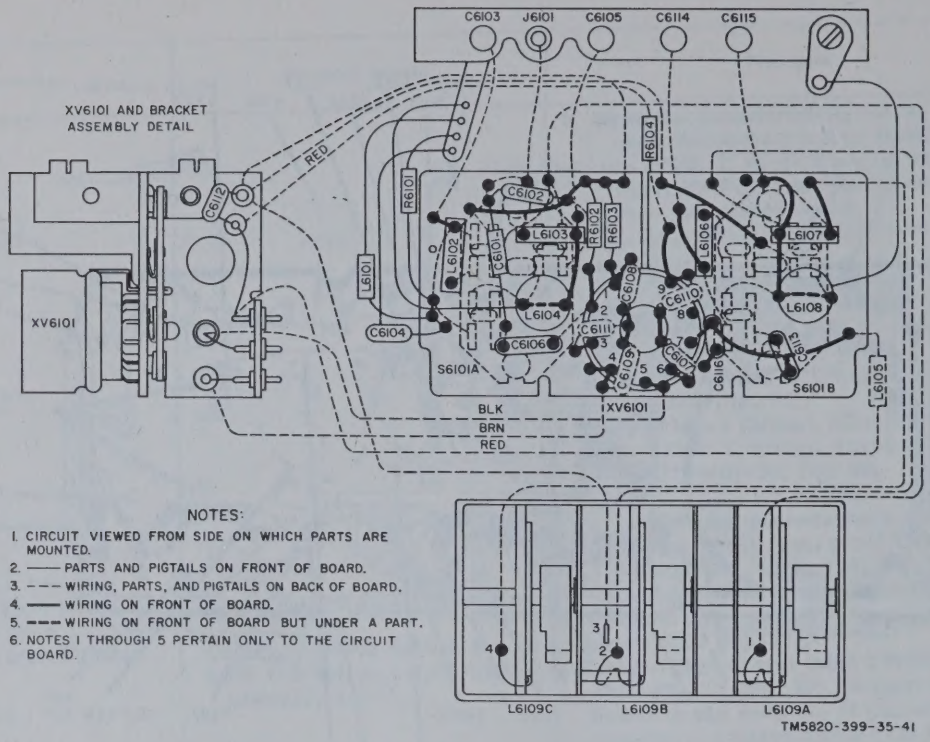


Figure 22. Assembly A6100, parts location and wiring diagram.

30. Isolating Troubles in Assembly A6200 (fig. 23, 24, 25, and 66)

When trouble has been localized to assembly A6200, use the following techniques to isolate the defective part.

a. Test tube V6201 by substitution.

b. Remove V6201 (TM 11-5820-401-20, para 14*b*) and take voltage measurements at the tube socket with the POWER switch in the HIGH position and the transmitter keyed (*d* below).

Warning: **When the receiver-transmitter is transmitting, contacts on its power supply and power amplifier tube are at a potential of +700 volts dc. Observe all safety precautions when working on the receiver-transmitter.**

c. If voltages are abnormal, turn the POWER switch to OFF, and make resistance measurements to isolate open or short circuits. Make all measurements between the indicated pin of XV6201 and ground.

Socket XV6201 voltage and resistance chart

Connection	Dc volts	Ohms
Plate yoke	+700	450K
Screen ring	+275	Infinity
Grid ring	-14	910
Cathode ring	0	0
Heater ring	+25.5	Greater than 0 but less than 50

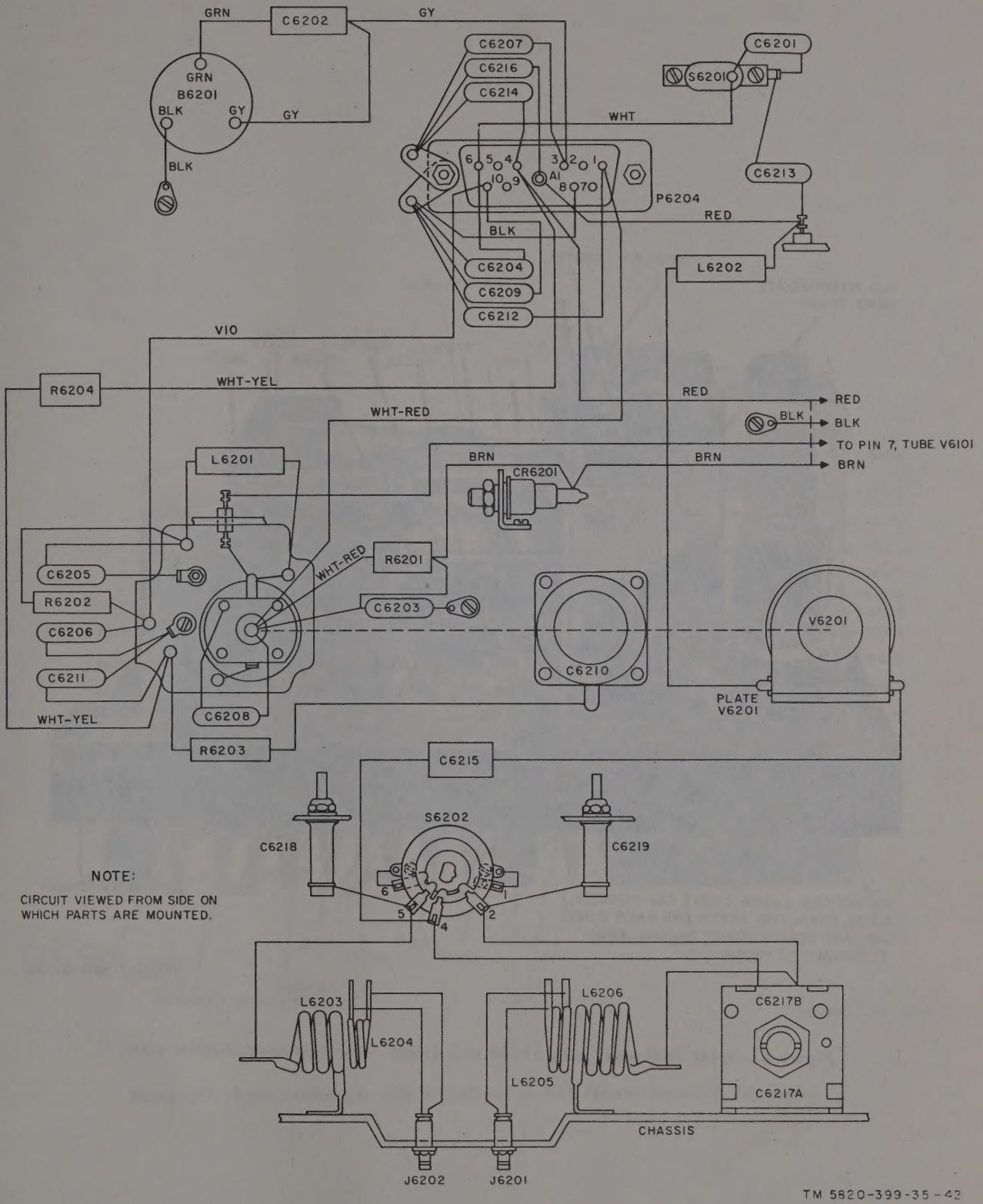


Figure 23. Assembly A6200, parts location and wiring diagram.

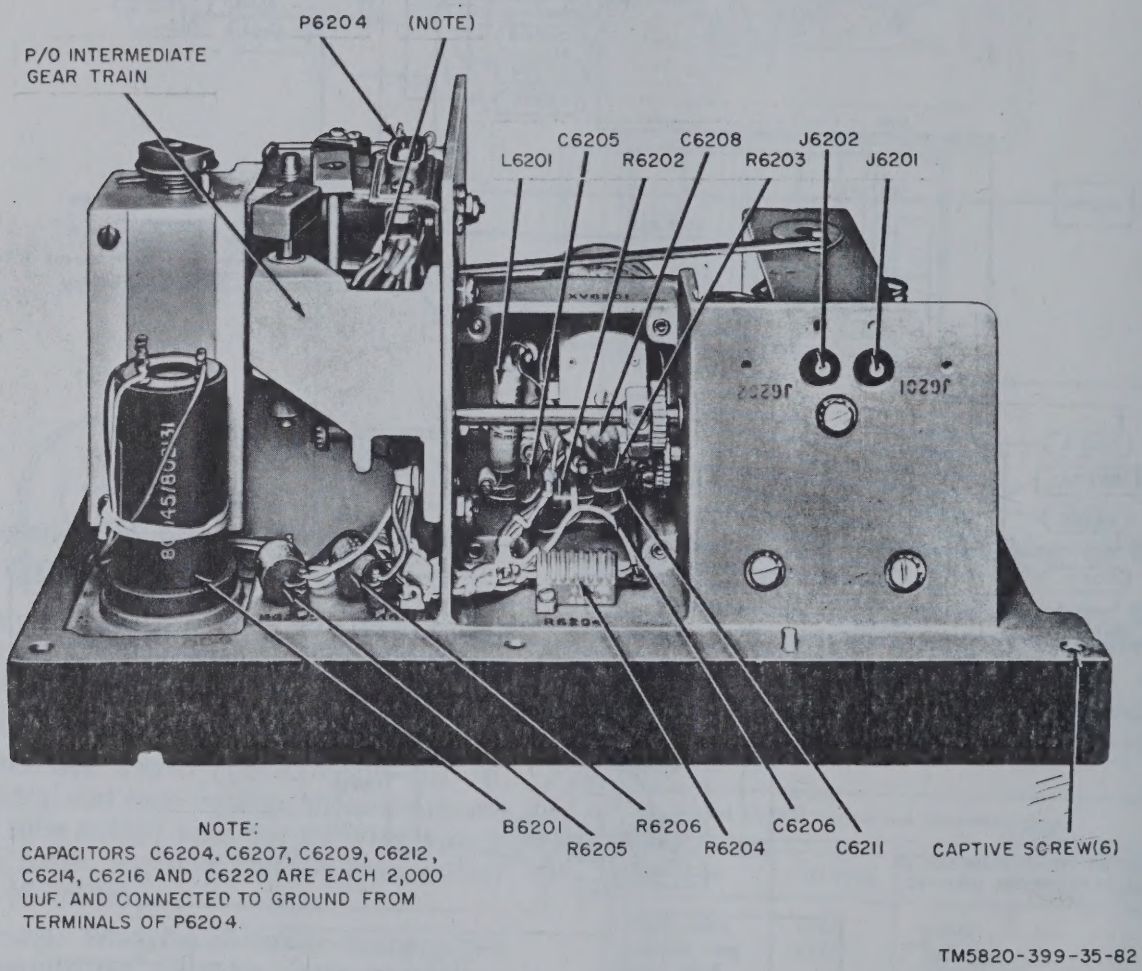


Figure 24. Heat exchanger with A6100 and A6200 covers removed, bottom view.

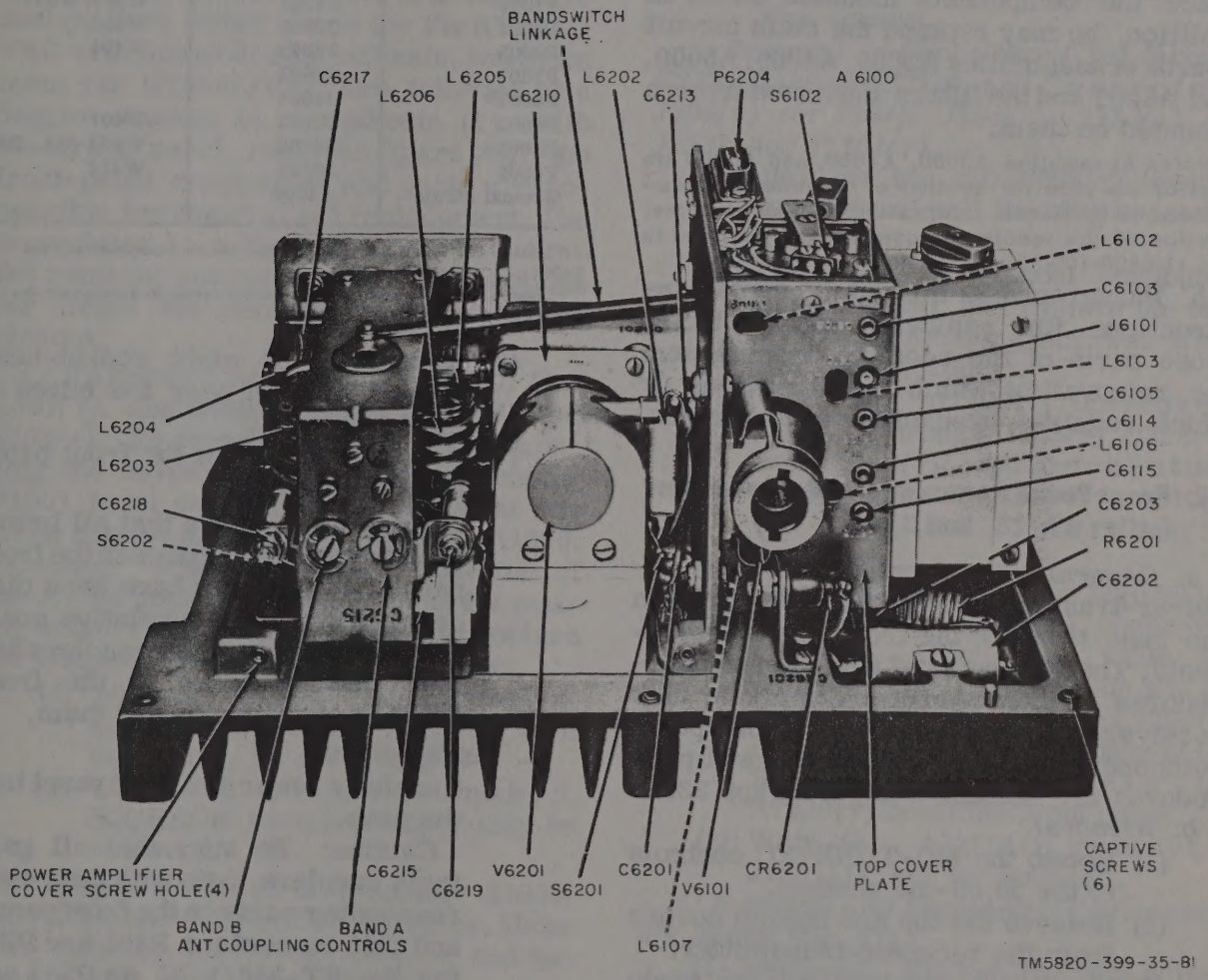


Figure 25. Heat exchanger with A6100 and A6200 covers removed, top view.

31. Scope of Third Echelon Repairs

a. The third echelon repairman may remove the front panel from the receiver-transmitter and replace the parts and assemblies mounted on it. He may also remove the heat exchanger (assemblies A6100 and A6200) from the case and replace the components mounted on it. In addition, he may replace the main circuit boards of assemblies A3000, A4000, A5000, and A8000 and the filters and transformers mounted on them.

Note: Assemblies A3000, A4000, and A5000 are part of the receiver section of the receiver-transmitter. Maintenance information for the receiver section of the receiver-transmitter is contained in TM 11-5820-409-35.

b. Paragraphs 32 through 38 contain instructions for removing and replacing those parts of the receiver-transmitter, the removal of which is not obvious or which requires precautionary measures.

32. Front-Panel Removal and Replacement (fig. 17, 18, and 21)

a. General. The front panel of the receiver-transmitter must be removed from the case to reach the front-panel components. The removal and replacement procedures in this paragraph apply to both receiver-transmitters. The front-panel component removal and replacement procedures are contained in paragraph 33.

b. Removal.

(1) Rotate the MC-TUNE-KC controls to the 30.00-mc channel.

(2) Remove the top and bottom covers from the receiver-transmitter.

(3) Stand the receiver on its back; swing out assemblies A3000, A8000, and A4000 and secure their braces.

(4) Remove antenna filter FL4501 (TM 11-5820-401-20, para 17*c*).

(5) Disconnect the plugs listed in the chart below.

Note: Figures 17 and 18 are for the RT-246/VRC, but the plug, receptacle, and cable locations are the same as for the RT-524/VRC. Cable locations are contained in TM 5820-401-20.

Plug	Receptacle	Cable
K301P1	J1 of K301	
K301P2	J2 of K301	
K301P3	J3 of K301	
P1001	J1001	
P1002	J1002	W303
P1003	J1003	W409
P1004	J1004	W202/W402
P1005	J1005	W201/W401
P2002	J2002	W403
P2003	J2003	W404
P3001	J3001	
P4001[a]	J4001	
P6001	J6001	W407
P6002	J6002	W408 (fig. 20)
P6202	J6202	W412
Ground strap[b]	A1000	

[a] Loosen the P4001 retaining screws before disconnecting the P4001.

[b] Loosen the ground strap lug-securing screw to disconnect the ground strap.

(6) Remove the eight socket-head screws located near the edges of the front panel.

(7) Carefully withdraw the front panel from the case.

Caution: Be sure that all interconnecting cables between the front panel and the case have been disconnected. Note the relative positions of all gear train couplers and their mating parts on the front panel; do not turn any of them.

c. Replacement.

(1) Carefully lower the front panel into the case.

Caution: Be sure that all gear train couplers mate with their corresponding parts on the front panel, and that connectors P301 and P302 for the RT-246/VRC or P351 and P352 for the RT-524/VRC mate properly.

(2) Replace the eight socket-head front-panel securing screws.

(3) Connect the plugs listed in *b*(5) above.

(4) Replace antenna filter FL401 (TM 11-5820-401-20, para 17*c*).

(5) Swing assemblies A3000, A8000, and A4000 into the case, and secure them.

(6) Replace the receiver-transmitter top and bottom covers.

33. Removal and Replacement of Front-Panel Assemblies and Parts (fig. 17, 18, and 21)

Removal and replacement procedures are similar for both receiver-transmitters, except for certain reference designations. Where designations are the same for both, no special symbol is used; where designations differ, those for the RT-524/VRC are enclosed in parenthesis, and those from the RT-246/VRC are followed by a dagger enlosed in parenthesis (†). With the front panel removed (para 32), the front-panel assemblies and parts are accessible for removal and replacement. The procedures in *a* through *k* below contain the removal and replacement instructions for items the removal of which is not obvious.

a. Removal of Assembly A1000, Coil L301(†), and Switches S302(†), (354), and S303(†). To remove assembly A1000, unplug the seven color-coded plugs, unplug P1001 from connector J1001, loosen the three captive nuts, and withdraw the A1000.

Caution: **Note the relative positions of the A1000 gear train coupler and its mating coupler on the front panel. Do not turn the couplers nor the band switch cam.**

(1) With the A1000 removed, coil L301(†), switches S303(†) and (S354) may be removed.

(2) With coil L301(†) removed, SQUELCH switch S302(†) may be removed.

b. Replacement of Assembly A1000. Carefully lower the A1000 into place. Make sure that the gear train coupler and the band switch cam mate with their corresponding parts on the front panel. Tighten the three captive nuts. Plug in the seven color-coded plugs. Plug P1001 into J1001.

c. Removal and Replacement of Assembly A2000.

(1) *Removal.* Unplug P2001 from J2001, P2002 from J2002, P2003 from J2003, and P1001 from J1001. Loosen the two captive screws and remove A2000.

Caution: **Note the relative positions of the A2000 gear grain coupler and its mating coupler on the front panel.**

(2) *Replacement.* Carefully lower the A2000 into position. Make sure that the gear train coupler mates with its corresponding part on the front panel. Plug P2001 into J2001, P2002 into J2002, P2003 into J2003, and P1001 into J1001. Tighten the captive screws.

d. Removal of Capacitors C301 through C322, C328 and C329, and Connectors J305(†) (or J354), J306(†), J310(†) (or J353), and J7101(†).

(1) Remove the two P302(†) bracket screws and pull the plug assembly aside.

(2) Open the front-panel pushbutton hinged cover and remove the four A7100(†) securing screws. Withdraw the A7100(†).

(3) With the A7100(†) removed, C301(†) through C322(†), C328(†), and C329(†), and connectors J305(†) (or J354), J306(†), J310(†) (or J353), and J7101(†) may be removed.

e. Removal of A7200(†) and J7201(†).

(1) Remove the A7200(†) cover-retaining screw and slide the A7200(†) cover straight up and off the A7200(†). Remove the A7200(†) retaining screws at the base of the A7200(†) and withdraw the A7200(†) from the front panel.

(2) With the A7200(†) removed, J7201(†) may be removed.

f. Removal and Replacement of Assembly A6000 (fig. 17).

(1) *Removal.* Unplug the two color-coded leads and loosen the three captive nuts at the base of A6000. Withdraw the A6000 from the front panel.

Caution: **Note the relative positions of the gear train couplers of the A6000 and their corresponding parts on the front panel.** ***Do not turn them.***

(2) *Replacement.* Carefully lower the A6000 into position. Make sure that

the gear train couplers mate with their corresponding parts on the front panel. Tighten the three captive nuts at the base of the A6000, and plug in the two color-coded leads.

g. Removal of Switches S307(†) (or S356), S309(†) (or S359), S304(†) (or S353), and Potentiometer R304(†).

(1) With the A6000 removed (*f*(1) above), switch S307(†) (or S356) may be removed.

(2) With the A6000, A7000(†) bracket, and A2000 (*c*(1) above) removed, switch S309(†) (or S359) may be removed.

(3) With switch S309(†) (or S359) removed, S304(†) (or S353) and potentiometer R304(†) may be removed.

h. Removal of Diode CR302(†) and Circuit Breaker CB301(†).

(1) Remove R301(†) to permit removal of CR302(†).

(2) With R301(†) and CR302(†) removed, CB301(†) may be removed.

i. Removal and Replacement of Potentiometer R303(†).

Caution: Be sure that the receiver-transmitter has been tuned to 30.00 mc before removing R303(†).

(1) *Removal.* Remove the retaining screws and slide out R303(†). Unsolder the three color-coded leads.

(2) *Replacement.* Solder the three color-coded leads to the terminals of R303(†). Turn the R303(†) shaft completely counterclockwise, and then turn it clockwise approximately three teeth. Load its mating antibacklash gear one tooth. Slide R303(†) into position; mesh its shaft gear with the mating antibacklash gear. Tighten the captive screws.

j. Removal and Replacement of Capacitors C323(†) Through C327(†) and C331(†). Remove transformer T301(†) to permit removal and replacement of C323(†) through C327(†), and C331(†).

k. Removal and Replacement of Servomotor-Generator MG-301(†).

(1) *Removal.* Remove the ten screw-on connections from the MG301(†). Loosen the three holddown screws, turn the holddown tabs, and withdraw the MG301(†) from the front panel.

(2) *Replacement.* Place the MG301(†) in position on the front panel, turn the holddown tabs, and tighten the three holddown screws. Replace the 10 screw-on connections on the MG301(†).

34. Removal and Replacement of Heat Exchanger

(fig. 24 and 25)

The heat exchanger must be removed from the case of the receiver-transmitter for access to the components mounted on the heat exchanger.

a. Removal.

(1) Turn the MC-TUNE-KC knobs to to 30.00 mc.

(2) Remove the top and bottom covers from the receiver-transmitter and stand it on its handles.

(3) Remove the shrouds from the right rear and back of the receiver-transmitter.

(4) Unplug P6202 from connector J6202, unplug P6201 from connector J6201, and unplug P6101 from the connector J6101 top (fig. 25).

(5) Loosen the six captive screws, on the rear of the receiver-transmitter (fig. 25), which secure the heat exchanger to the case.

(6) Carefully withdraw the heat exchanger from the case and stand it on its back.

Caution: Note the relative positions of all gear train couplers and their corresponding parts in the case. Do not turn any of them.

b. Removal of Blower Motor B6201. With the heat exchanger removed (*a* above), blower motor B6201 may be removed.

c. Replacement.

(1) Gently lower the heat exchanger into the receiver-transmitter case. Center the heat exchanger alignment pins with their mating holes

in the receiver-transmitter case. Adjust the mating halves of the gear train couplers so that they engage. Be sure that P6204 lines up with J6204. Rock the heat exchanger slightly while pressing down on it.

Caution: **Do not tighten any of the heat exchanger captive screws until the heat exchanger is fully in position.**

(2) Tighten the heat exchanger captive screws.

(3) Replace and secure the two heat exchanger shrouds.

(4) Plug P6202 into J6202, P6201 into J6201, and P6101 into J6101.

(5) Replace and secure the receiver-transmitter top and bottom covers.

35. Removal and Replacement of Band Switch Motor B401 and Components Within Assembly A6200
(fig. 23, 24 and 25)

With the heat exchanger removed (para 34), the following parts of Assembly A6000 may be removed as instructed below.

a. Band Switch Motor B401. The B401 is located next to V6101.

b. Capacitors C6204, C6207, C6209, C6212, C6214, and C6216. Remove connector P6204 and its bracket to permit removal of C6204, C6207, C6209, C6212, C6214, and C6216.

c. Capacitors C6201 and C6213, and Coil L6202. Remove the four A6200 cover screws and the cover to permit removal of C6201, C6213, and L6202.

d. Capacitors C6205, C6208 and C6211, Coil L6201, and Resistors R6202 and R6203. Remove V6201 (TM 11-5820-401-20, para 14*b*(1)), and the C6210 (XV6201 socket cover) to permit removal of C6205, C6206, C6208, C6211, L6201, R6202, and R6203.

36. Removal and Replacement of Driver Assembly A6100, C6203, and R6201
(fig. 24 and 25)

With the heat exchanger removed (para 34), the A6100, C6203 and R6201 may be removed and replaced as follows:

a. Removal of Assembly A6100.

(1) Remove the C-washer from the band switch linkage, and remove the band switch linkage.

(2) Unplug the three color-coded leads from assembly A6100.

(3) Loosen the two captive screws and remove the cover from the bottom (blower motor B6201 side) of A6100.

(4) Carefully unsolder the connection from C6116 (shown as a dotted line in figure 22).

(5) Use a long slender-bladed screwdriver to remove the four screws, which secure assembly A6100 from the heat exchanger.

b. Removal of C6203 and R6201. With the A6100 removed (*a* above), C6203 and R6201 may be removed.

c. Replacement of Assembly A6100.

(1) Replace the four screws that secure the A6100 to the heat exchanger.

(2) Carefully replace and solder the connection to C6116.

(3) Replace the cover and tighten the two captive screws on the A6100.

(4) Plug in the three color-coded leads.

(5) Replace the band switch linkage and the C-washer.

37. Removal and Replacement of Assembly A8000 Main Circuit Board
(fig. 26)

a. Removal.

(1) Perform the removal procedures described in TM 11-5820-401-20, paragraph 17*b*(1).

(2) Loosen the two screws that secure P8001, and unplug it.

(3) Release the brace, remove the retaining rings, withdraw the hinge pins, and remove the A8000 from the case.

(4) Unsolder and remove filter FL8001, capacitor C8001, and connector J8001 from the main circuit board.

(5) Remove the main circuit board from its backing plate.

b. Replacement.

(1) Position the main circuit board on its backing plate.

(2) Replace and solder FL8001, C8001, and J8001.

(3) Place the A8000 in position, insert the hinge pins, replace the retaining rings, and secure the brace.

(4) Plug in P8001 and tighten the two securing screws.

(5) Perform the replacement procedures covered in TM 11-5820-401-20, paragraph 17*b*(2).

38. Removal and Replacement of Assemblies A6300 and A6400

(fig. 17 and 27)

a. Removal.

(1) Remove the top cover from the receiver-transmitter.

(2) Unplug P6002 from J6002, unplug P6001 from J6001, and unplug P6003 from J6003.

(3) Remove the circuit board extractor from the cover of assembly A6000.

(4) Remove the two securing screws and the cover from assembly A6000.

(5) Hook the circuit board extractor into the assembly to be removed, and remove the assembly.

Caution: **Be sure to pull the assembly straight up.**

b. Replacement.

(1) Insert the assembly into its slot in the assembly A6000 and carefully push it down.

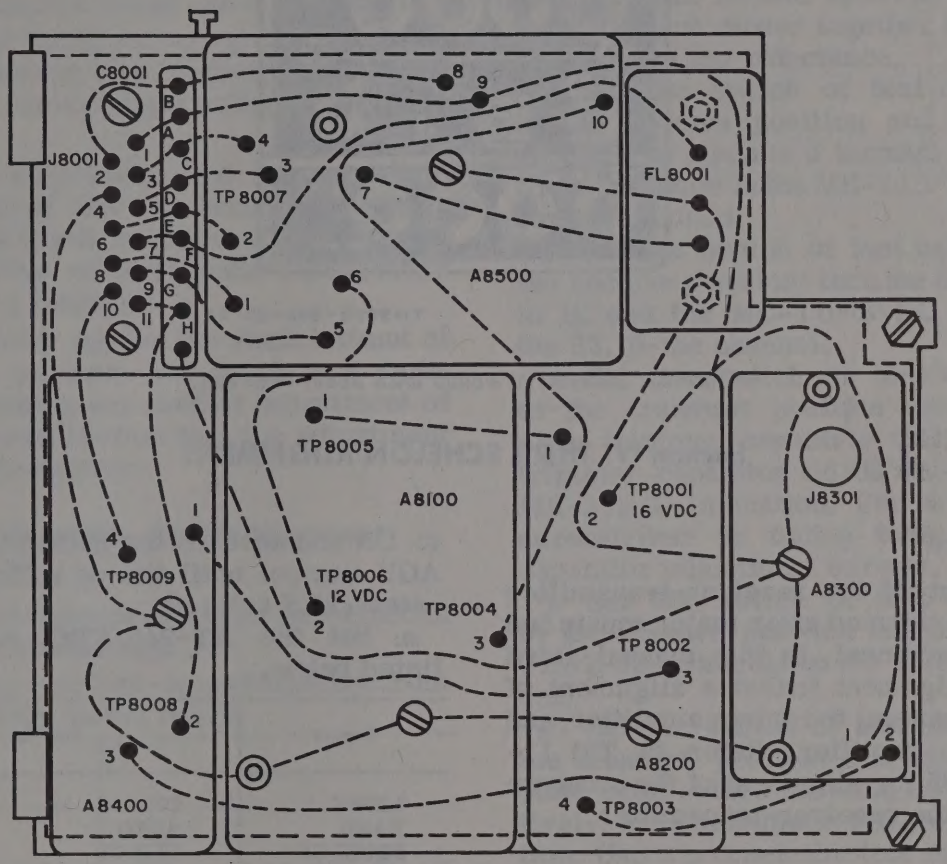
Caution: **Check to be sure that the band switch on the circuit board mates with its actuating pawl in assembly A6000.**

(2) Replace the cover and the two securing screws of assembly A6000.

(3) Replace the circuit board extractor on the cover of assembly A6000.

(4) Plug P6003 into J6003, P6001 into J6001, and P6002 into J6002.

(5) Replace the top cover on the receiver-transmitter.



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. — — WIRING ON BACK OF BOARD.
4. TP DENOTES TEST POINT.

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Figure 26. Assembly A8000, parts location and wiring diagram.

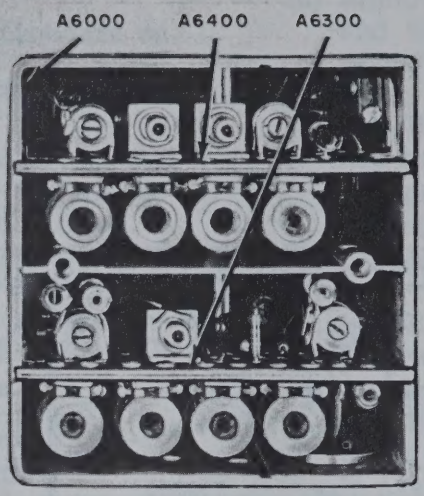


Figure 27. Assembly A6000 with cover removed.

Section IV. THIRD ECHELON ALIGNMENT

39. General

Alignment of the receiver-transmitter must be performed after major repair and parts replacement. In this manual, third echelon alignment includes alignment of the servosystem, the driver amplifier, and the power amplifier. Refer to TM 11-5820-409-35 for alignment of the receiver portion of the receiver-transmitter.

40. Servosystem Alignment (RT-246/VRC only)

Align the servosystem as directed in *a* through *l* below. Do not change the control settings unless specifically directed.

a. Check to be sure that the receiver-transmitter POWER switch is in the OFF position and that the PP-1104A/G circuit breakers are in their OFF positions.

b. Turn the PP-1104A/G INCREASE VOLTAGE control fully counterclockwise.

c. Connect test cable No. 1, the PP-1104A/G, and Radio Frequency Wattmeter AN/URM-43A to the receiver-transmitter (fig. 39).

d. Set the PP-1104A/G circuit breakers to ON and advance the INCREASE VOLTAGE control until the dc voltmeter indicates +25.5 volts dc.

e. Set the RT-246/VRC controls as listed below.

Control	Position
LIGHT	ON
BAND	AUTO
SQUELCH	OLD ON
VOLUME	Fully counterclockwise
POWER	LOW

f. Remove the RT-246/VRC top cover. Loosen the shaft locknut on potentiometer R304 (fig. 17), and adjust potentiometer R304 fully clockwise and then counterclockwise 1/8 turn.

g. Adjust pushbutton No. 1 preset potentiometer to the 30.00-mc channel and pushbutton No. 2 preset potentiometer to the 48.00-mc channel (TM 11-5820-401-20, para 8).

h. Alternately press pushbutton No. 1 and pushbutton No. 2. As the servosystem approaches the channel which is preset press the TUNE pushbutton and adjust

potentiometer R304 until the servomotor starts hunting. Turn R304 in the opposite direction to prevent hunting, but not so much that tuning time will be increased.

i. When potentiometer R304 appears to be adjusted properly, adjust the INCREASE VOLTAGE control of the PP-1104A/G until the dc voltmeter reads +20.0 volts dc.

j. Repeat the procedure given in *h* above without making any further adjustment unless the servosystem action is unsatisfactory.

k. If an adjustment was required in *j* above, repeat the procedure given in *h* above with input voltages of +25.5 volts dc and +20.0 volts dc until satisfactory operation is obtained.

l. Carefully tighten the shaft locknut of R304 and perform the check in *h* above (without making any further adjustment of R304) to make certain that the adjustment is still satisfactory.

41. Driver Assembly A6100 Alignment (fig. 25)

a. Perform the procedures described in paragraph 40a through *e*.

b. Set the receiver-transmitter controls to the settings listed below.

Control	Setting
LIGHT	ON
BAND	A
MC-TUNE-KC	30.00 mc
SQUELCH	OLD ON
VOLUME	Fully counterclockwise
SPKR	OFF (RT-524/VRC)
POWER	HIGH

c. Connect an ME-26B/U between TP9006 and ground, and measure the dc voltage. An indication of -1 to -1.5 volts dc indicates proper grid drive to V6201.

d. Set the switch of test cable No. 1 (fig. 28) to the transmit position and adjust grid and plate trimmer capacitors C6103 and C6114, respectively, for a maximum ME-26B/U indication. Use a tuning tool or a nonmetallic screwdriver to turn the capacitor adjusting screws.

e. Set the switch of test cable No. 1 to the receive position and turn the MC-TUNE-KC controls to the 29.90-mc channel.

f. Set the switch of test cable No. 1 to the transmit position and adjust grid and plate limit coils L6102 and L6106, respectively, for a maximum ME-26B/U indication. Use a nonmetallic tool to spread the coil turns farther apart or to squeeze the coil turns closer together to decrease or increase the inductance.

g. Set the switch of test cable No. 1 to the receive position and repeat the procedures given in *d* through *f* above until no increase in the ME-26B/U indication can be obtained.

h. Set the switch of test cable No. 1 to the receive position; turn the BAND switch to B, and the MC-TUNE-KC controls to the 53.10-mc channel.

i. Set the switch of test cable No. 1 to the transmit position and adjust the plate trimmer capacitor C6115 and grid trimmer capacitor C6105 for a maximum ME-26B/U indication. Use a nonmetallic screwdriver or tuning tool to turn the capacitor adjustment screws.

j. Set the switch of test cable No. 1 to the receive position and turn the MC-TUNE-KC controls to the 75.85-mc channel.

k. Set the switch of test cable No. 1 to the transmit position and adjust grid and plate limit coils L6103 and L6107, respectively, for a maximum ME-26B/U indication. Use a nonmetallic tool for spreading or squeezing the coil turns to decrease or increase the inductance of the coils.

l. Set the switch of test cable No. 1 to the receive position, turn the MC TUNE KC controls to the 53.10-mc channel, and repeat the procedures given in *i* through *k* above until no further increase in ME-26B/U indication can be obtained.

m. Set the switch of test cable No. 1 to the receive position and proceed to the power amplifier assembly alignment (para 42).

42. Power Amplifier Assembly A6200 Adjustment (fig. 24 and 25)

After completing the driver amplifier assembly alignment (para 41), align the

power amplifier assembly as described in *a* through *p* below.

a. Turn the BAND switch to A and the MC-TUNE-KC controls to the 52.90-mc channel.

b. Swing out the A8000 assembly and secure its brace. Connect the ME-26B/U between test point TP9007 (fig. 29) and ground. Set the switch of test cable No. 1 to the transmit position. A normal ME-26B/U indication is approximately 0.5 volt ac.

Warning: **Dangerous rf voltages exist in assembly A6200. Use insulated tools to make all adjustments.**

c. Adjust BAND A trimmer capacitor C6219 for a minimum ME-26B/U indication. Make a small readjustment of the C6219 for an increase in rf power output as indicated by the AN/URM-43A. The increase in ME-26B/U indication must not exceed 0.05 volt.

Note: Throughout this procedure, the statement *increasing rf power output side of ME-26B/U minimum* means that more rf power output can be obtained when the particular circuit is adjusted slightly off the minimum ME-26B/U indication (slightly off resonance).

d. Adjust the BAND A ANT CPLG control for an AN/URM-43A indication of 40 watts. Turning the BAND A ANT CPLG control counterclockwise increases the antenna coupling.

e. Repeat the procedure given in *c* above.

f. Set the switch of test cable No. 1 to the receive position, turn the MC-TUNE-KC controls to the 30.00-mc channel, and set the switch of test cable No. 1 to the transmit position.

g. Adjust coil L6206 for a minimum ME-26B/U indication. Make a small readjustment of L6206 for an increase in rf power output as indicated by the AN/URM-43A. The increase in the ME-26B/U indication must not exceed 0.05 volt. Adjust L6206 by spreading its turns farther apart or squeezing them closer together with a nonmetallic tool.

h. Set the switch of test cable No. 1 to the receive position and repeat the procedures covered in *a* through *g* above until the band limit points are adjusted on the increasing rf power output side of the ME-26B/U minimum indications.

i. Set the switch of test cable No. 1 to the receive position, turn the BAND switch to B, and turn the MC-TUNE-KC controls to the 75.90-mc channel.

j. Set the switch of test cable No. 1 to the transmit position and adjust the BAND B trimmer capacitor C6218 for a minimum ME-26B/U indication. Make a small readjustment of C6218 for an increase in rf power output as indicated by the AN/URM-43A. The increase in the ME-26B/U indication must not exceed 0.05 volt.

k. Adjust the BAND B ANT CPLG control for an AN/URM-43A indication of 40 watts.

l. Repeat the procedure given in *j* above.

m. Set the switch of test cable No. 1 to the receive position, turn the MC-TUNE-KC controls to the 53.00-mc channel, and set the switch of test cable No. 1 to the transmit position.

n. Adjust coil L6203 for a minimum ME-26B/U indication. Make a small readjustment of L6203 for an increase in rf power output as indicated by the AN/URM-43A. The increase in ME-26B/U indication must not exceed 0.05 volt. Adjust L6203 by spreading its turns farther apart or squeezing them closer together with a nonmetallic tool.

o. Set the switch of test cable No. 1 to the receive position and repeat the procedures given in *i* through *n* above until the band limit points are adjusted on the increasing rf power output side of the ME-26B/U minimum indications.

p. Set the switch of test cable No. 1 to the receive position, turn the equipment off, and disconnect the ME-26B/U.

CHAPTER 4

FOURTH ECHELON MAINTENANCE

Section I. FOURTH ECHELON TROUBLESHOOTING

43. Scope of Fourth Echelon Maintenance

Fourth echelon troubleshooting *supplements* third echelon troubleshooting and in this manual consists of isolating troubles in assembly A9000, pushbutton assembly A7100 (RT-246/VRC), the intermediate gear train, and the front-panel gear train. Fourth echelon troubleshooting of the receiver portion of the receiver-transmitter is covered in TM 11-5820-409-35.

44. Test Equipment and Additional Equipment Required

In addition to the test equipment authorized for third echelon use (para 26), the following equipment is required.

Tool Kit TK-87/U (FSN 5180-690-4452).

Torque tool, 0-50-inch-ounce capacity left and right.

45. Isolating Trouble in Assembly A9000 (fig. 29, 30, and 31)

When trouble has been localized to assembly A9000, use the following techniques to isolate the defective part.

a. Remove the five securing screws and swing out the test point board of assembly A9000.

b. Use the ME-26B/U to measure the voltages at the junctions (fig. 30, unless otherwise noted) listed below and compare them to the typical values listed. All measurements are made between the listed junctions and ground. Measure the voltages with the POWER switch in the HIGH position and the transmitter keyed.

Warning: **When the receiver-transmitter is transmitting, the contacts on its power supply and the power amplifier are at a potential of +700 volts dc. Observe all safety precautions when working on a receiver-transmitter.**

Junction	Dc voltage
C9001 and L9001 (red)	+24.5
L9001 (brn) and CR9015	+24.5
CR9015 and T9001-2	+23.4
R9010 and R9012 (fig. 31)	+29.0
CR9001 and XK9002-3	0
CR9001 and XK9001-3	0
CR9010 and CR9011	+260
CR9010 and CR9006	+350
CR9006 and CR9007	+400
CR9008 and CR9009	+400
CR9009 and CR9013	+350
CR9013 and CR9012	+260
R9004 and R9003	+470
R9003 and R9001	+240
CR9002 and CR9004	+120
CR9003 and CR9005	+120
R9007 and CR9014	-24.5
R9009 and T9002 (fig. 31)	+24
R9009 and XK9002-2, -6 (fig. 31)	+25.4

c. If the voltages (*b* above) were abnormal, perform the following procedures.

(1) Turn the POWER switch to OFF.

(2) Remove assembly A9000 from the receiver-transmitter (TM 11-5820-401-20, para 17*e*).

(3) Turn the ME-26B/U FUNCTION switch to OHMS.

Note: When the FUNCTION switch of the ME-26B/U is in the OHMS position, the COMMON lead is positive.

(4) Make the resistance measurements listed in the chart below.

Note: The transistors in assembly A9000 are power types and will not be damaged by the resistance measurements.

d. Use the schematic diagram (fig. 64), the parts location and wiring diagrams (fig. 30 and 31), and the chart below to isolate the faulty components. The *Reading* column lists the order of the tests. The *J9001 terminal* and the *ME-26B/U test lead* columns list the ME-26B/U test lead to be connected and the J9001 (fig. 20) terminal. The *Meter scale* column lists the position of the ME-26B/U RANGE

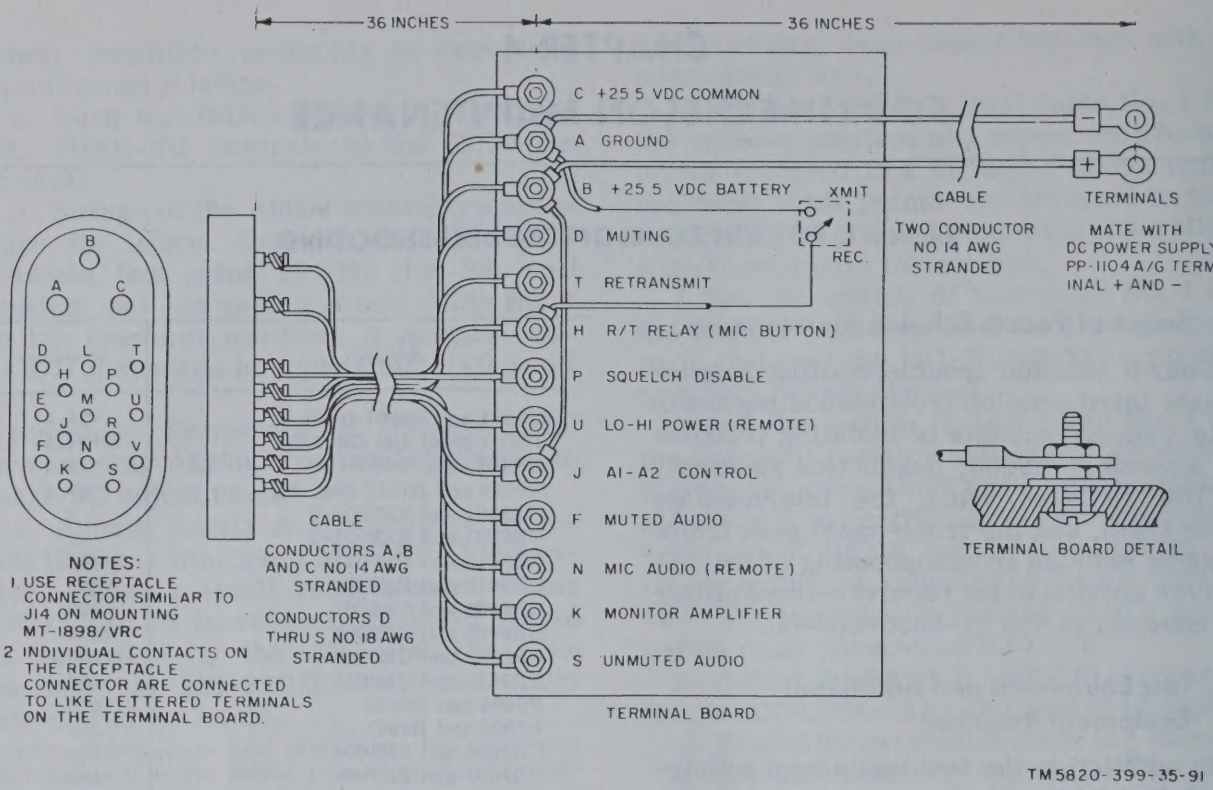

36 INCHES
36 INCHES
C +25 5 VDC COMMON
A GROUND
B +25 5 VDC BATTERY
XMIT
REC
D MUTING
T RETRANSMIT
H R/T RELAY (MIC BUTTON)
P SQUELCH DISABLE
U LO-HI POWER (REMOTE)
J A1-A2 CONTROL
F MUTED AUDIO
N MIC AUDIO (REMOTE)
K MONITOR AMPLIFIER
S UNMUTED AUDIO
TERMINAL BOARD
CABLE
TWO CONDUCTOR NO 14 AWG STRANDED
TERMINALS
MATE WITH DC POWER SUPPLY PP-1104A/G TERMINAL + AND –
TERMINAL BOARD DETAIL
CABLE
CONDUCTORS A,B AND C NO 14 AWG STRANDED
CONDUCTORS D THRU S NO 18 AWG STRANDED
NOTES:
1 USE RECEPTACLE CONNECTOR SIMILAR TO J14 ON MOUNTING MT-1898/VRC
2 INDIVIDUAL CONTACTS ON THE RECEPTACLE CONNECTOR ARE CONNECTED TO LIKE LETTERED TERMINALS ON THE TERMINAL BOARD.
TM5820-399-35-91

Figure 28. Test cable No. 1, fabrication illustration.

switch for the particular test. The *Resistance* column lists the indications to be expected when testing a normally operating A9000.

Note: When the OHMS lead is connected to the J9001 terminal, connect the COMMON lead to ground. When the COMMON lead is connected to the J9001 terminal, connect the OHMS lead to ground.

Reading	J9001 terminal	ME-26B/U test lead	Meter scale	Resistance
1	13	Ohms	R x 100	Record[a]
2	14	Ohms	R x 100	Record[a]
3	7	Ohms	R x 100	Record[a]
4	8	Ohms	R x 100	Record[a]
5	13	Common	R x 1	Less than reading No. 1
6	14	Common	R x 1	Less than reading No. 2
7	7	Common	R x 1	Less than reading No. 3
8	8	Common	R x 1	Less than reading No. 4
9	11	Ohms	R x 1	Record[a]
10	2	Ohms	R x 1	Record[a]
11	1	Ohms	R x 1	Record[a]
12	9	Ohms	R x 1	Record[a]
13	11	Common	R x 100	Greater than reading No. 9
14	2	Common	R x 100	Greater than reading No. 10
15	1	Common	R x 100	Greater than reading No. 11
16	9	Common	R x 100	Greater than reading No. 12

[a] Greater than 0, but less than infinity.

e. The chart below lists the dc resistance of the transformer and coil windings. All resistance listings in the chart are within +0 and -20 percent. Replace any defective transformers or coils (para 51).

Transformer	Leads	Dc resistance (ohms) maximum
T9001	1 to 3	0.03
	Orange to red	0.24
	Brown to red	0.24

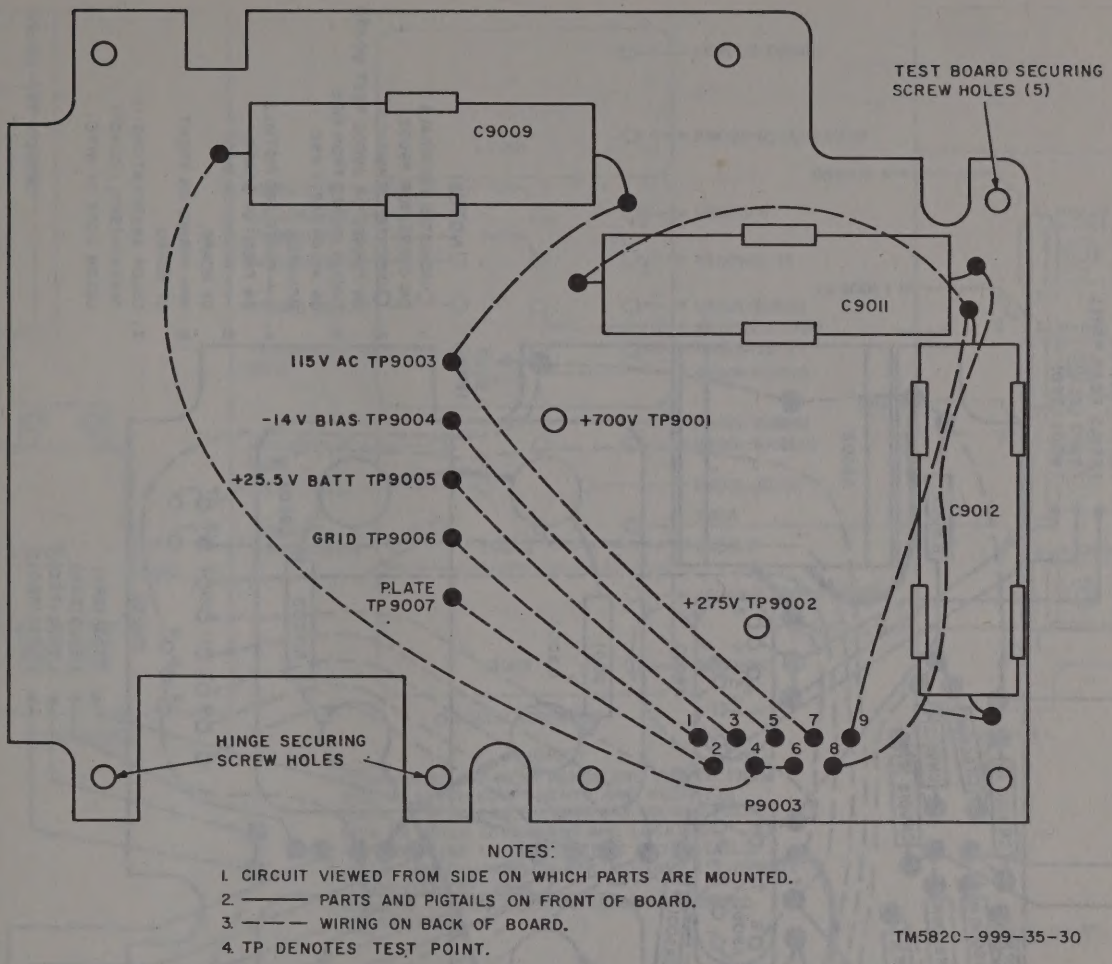


Figure 29. Assembly A9000 test circuit board, parts location and wiring diagram.

Transformer	Leads	Dc resistance (ohms) maximum
	Gray to white	0.77
	Blue to violet	7.75
	Yellow to green	4.6
T9002	Brown to orange	0.55
	Violet to gray	7.0
	Yellow to blue	12.0
L9003	Red to Brown	0.06
L9002	Red to Brown	9.0

46. Isolating Troubles in Pushbotton Assembly A7100 (RT-246/VRC)

Most troubles in the A7100 must be isolated with the A7100 removed from the RT-246/VRC and disassembled (para 54). Use figures 32 through 35 to locate and identify the parts, and figure 68 for the continuity checks.

47. Checking Intermediate Gear Train

a. Remove the heat exchanger (para 34).

b. Dismount band switch motor B401 (para 35*a*).

c. Check the torque at the coupler (item 4, fig. 61). A normal indication is 3 inch-ounces maximum either clockwise or counterclockwise.

d. If the indication is normal, replace the band switch motor; if not, refer to the intermediate gear train removal and replacement procedures (para 56).

48. Checking Front-Panel Gear Train

a. Turn the MC-TUNE-KC knobs through their full range. Normal coverage is from 30.00 to 52.95 mc as indicated by the tuning dial.

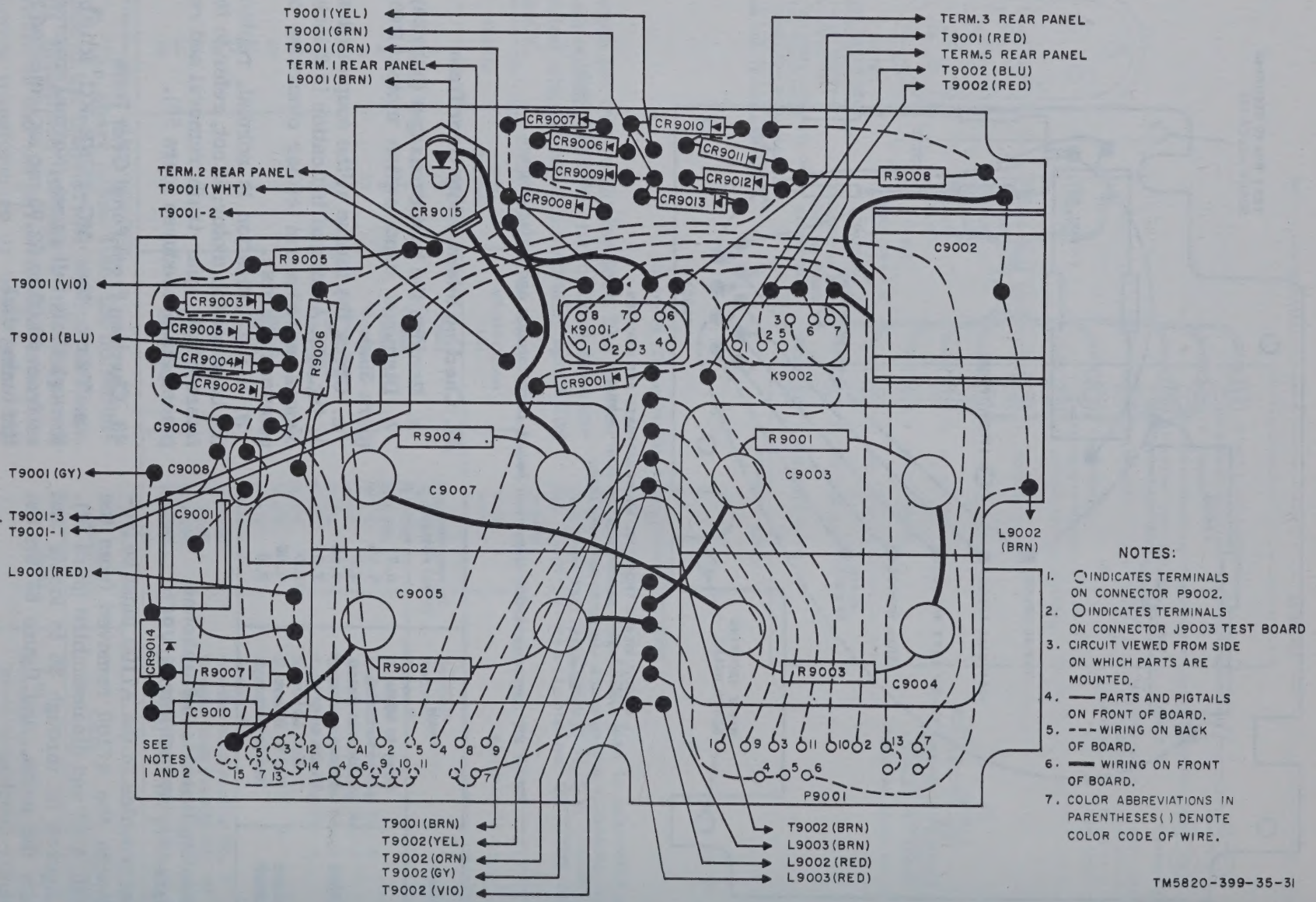


Figure 30. Assembly A9000 component circuit board, parts location and wiring diagram.

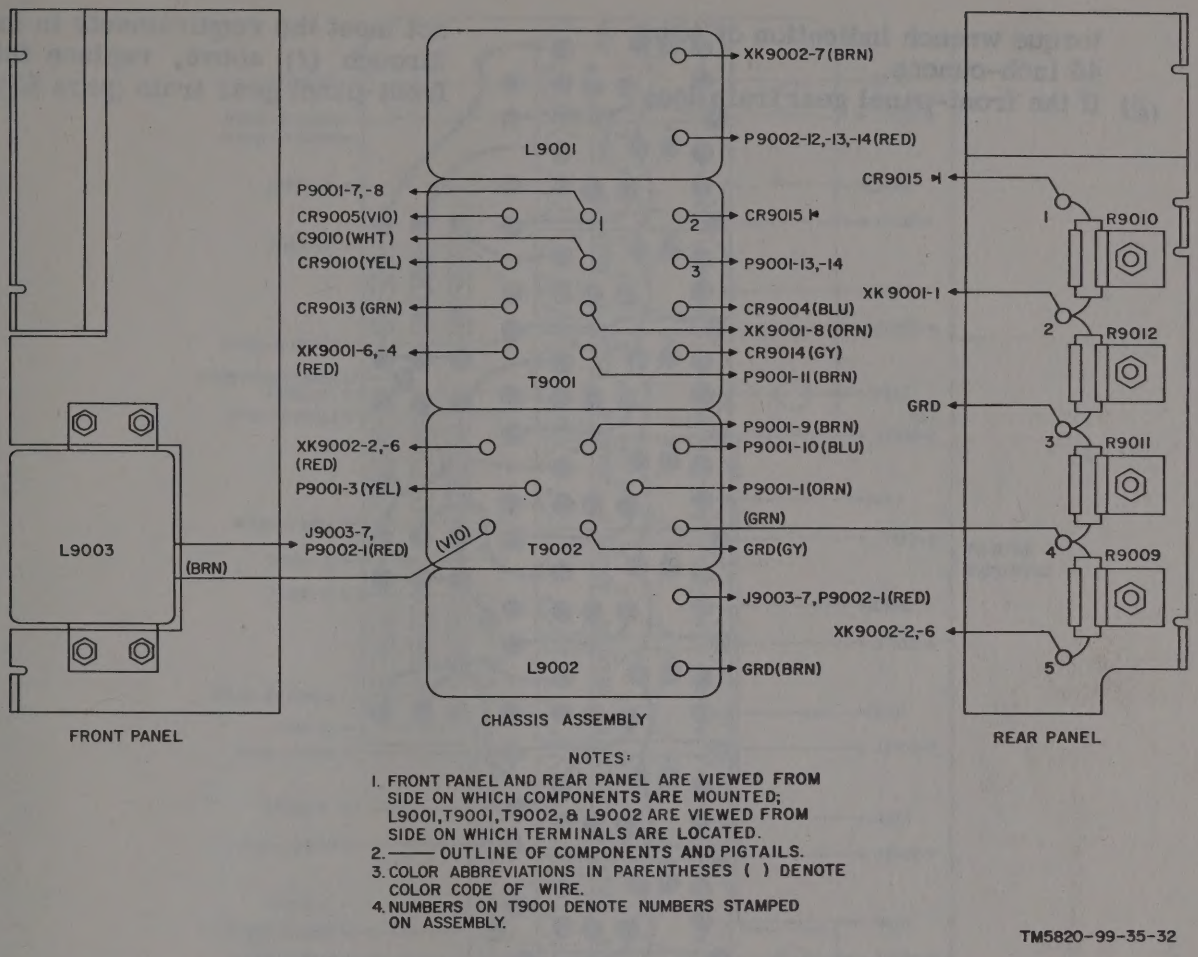


Figure 31. Assembly A9000 inductors and transformers, parts location and wiring diagram.

b. Turn the MC-TUNE-KC controls for a 30.50-mc indication. Center the dial numbers and mask openings on an imaginary horizontal centerline through the MC-TUNE-KC shafts.

c. Connect the ME-26B/U between the receiver-transmitter housing and the blade assembly (fig. 21). Check for continuity between adjacent detent positions as the mc shaft is rotated through its complete range.

d. Check the starting torque (para 44) at the kilocycle (kc) control shaft.

(1) For the RT-246/VRC, 13 inch-ounces is normal.

(2) For the RT-524/VRC, perform the following procedures to check the starting torque:

(a) Unscrew, as a unit, the housing kc detent assembly consisting of items 84 through 87, figure 63.

(b) Measure the torque at the kc control shaft; 8 inch-ounces is normal.

(c) Screw the kc detent housing assembly into place.

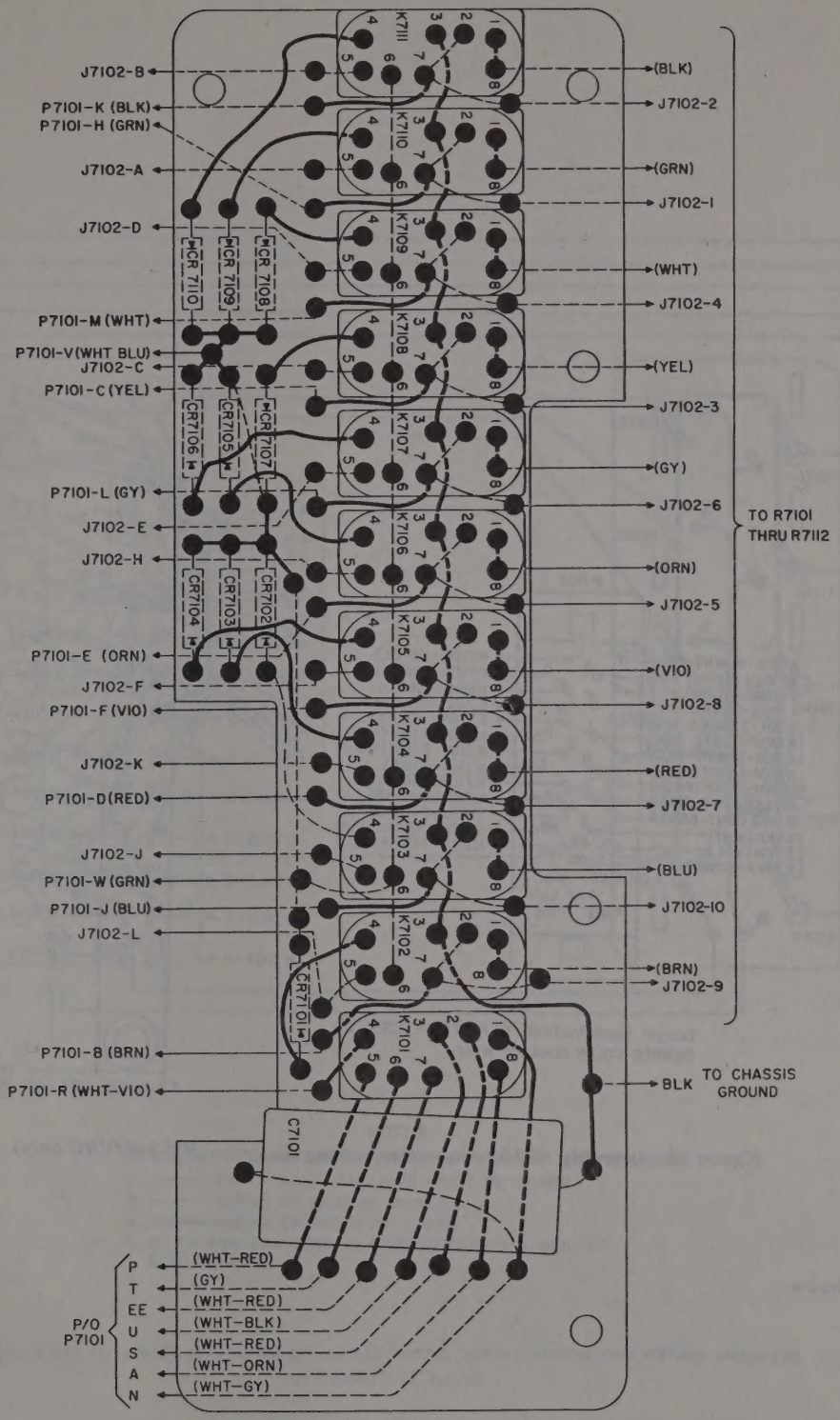
(d) Check the torque at the kc detent gear (item 51, fig. 63). The normal indication is 30 to 35 inch-ounces.

(e) If the indication was normal in *(b)* above but abnormal in *(d)* above, adjust the kc detent spring setscrew (item 84, fig. 63) for a torque wrench indication of 30 to 35 inch-ounces.

(f) Check the torque at the band switch control shaft. An indication of 40 to 45 inch-ounces is normal. If the indication is abnormal, adjust the detent spring setscrew (item 46, fig. 63) for a

torque wrench indication of 40 to 45 inch-ounces.

(g) If the front-panel gear train does not meet the requirements in (*a*) through (*f*) above, replace the front-panel gear train (para 55).



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. — — — WIRING, PARTS, AND PIGTAILS ON BACK OF BOARD.
4. ——— WIRING ON FRONT OF BOARD.
5. — — — WIRING ON FRONT OF BOARD BUT UNDER A PART.
6. COLOR ABBREVIATIONS IN PARENTHESES ( ) DENOTES COLOR CODE OF WIRE.

TM5820-399-35-26

Figure 32. Assembly A7100 relay circuit board, parts location and wiring diagram (RT-246/VRC only).

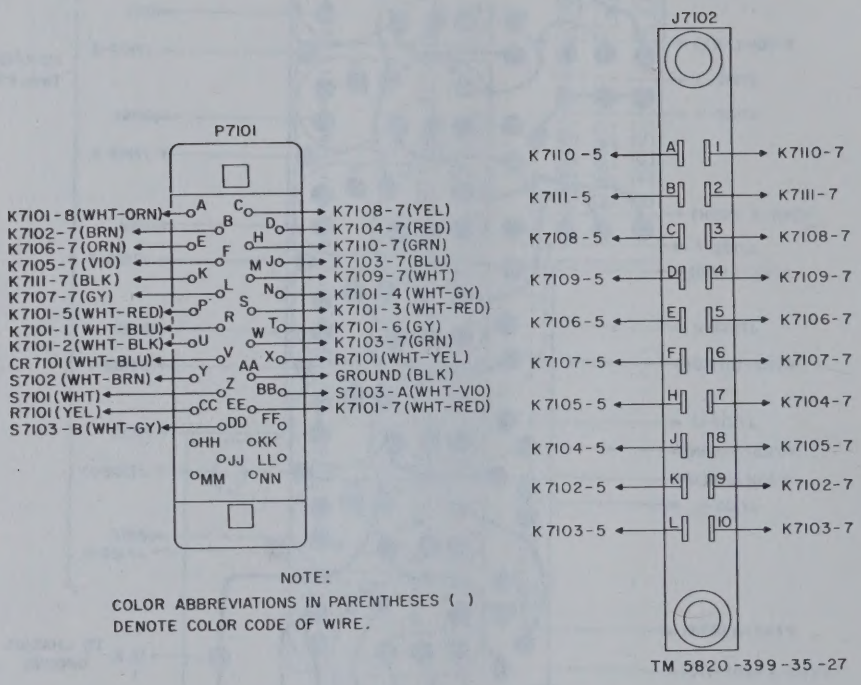
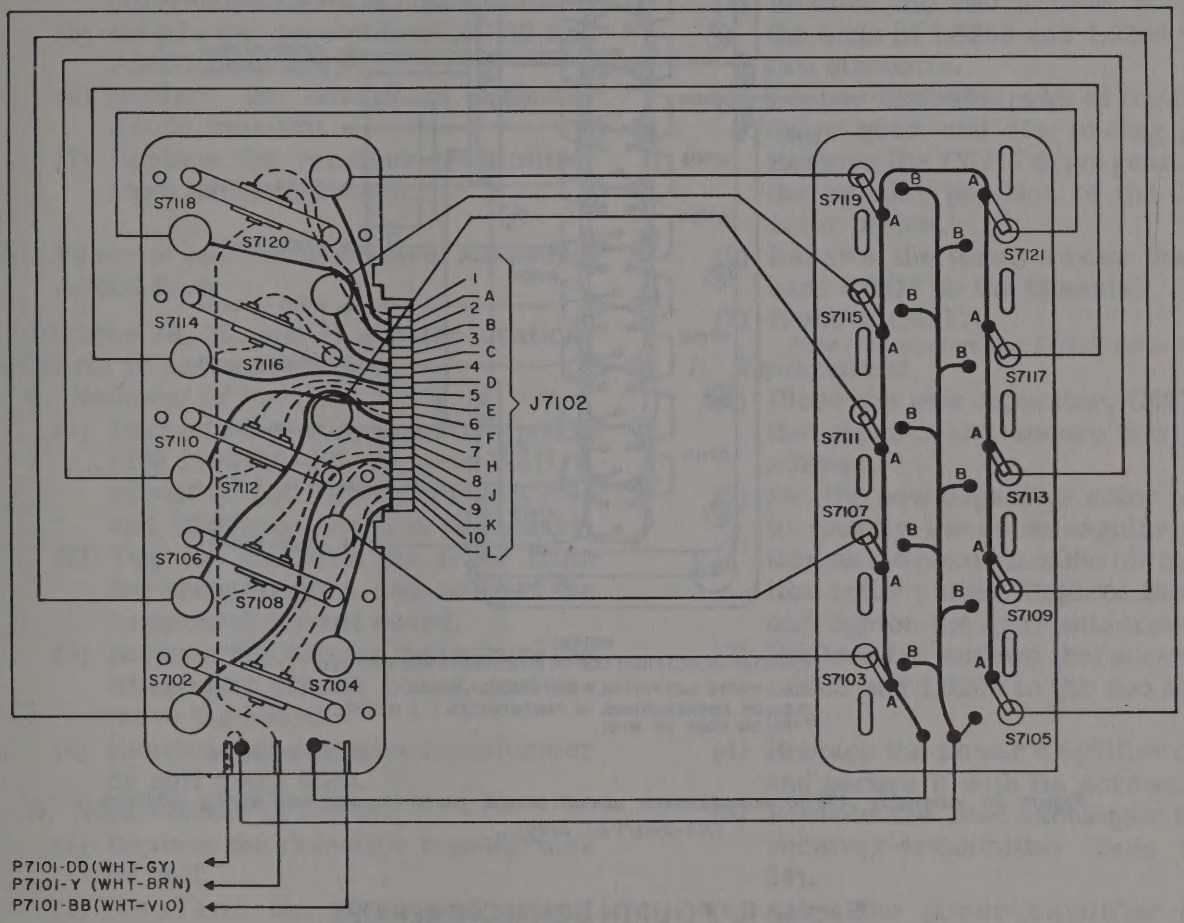


Figure 33. Assembly A7100 connectors, wiring diagram (RT-246/VRC only).



NOTES

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. — — — WIRING ON BACK OF BOARD.
4. ▬▬▬ WIRING ON FRONT OF BOARD.
5. COLOR ABBREVIATIONS IN PARENTHESES ( ) DENOTE CODE OF WIRE.

TM5820-399-35-28

Figure 34. Assembly A7100 switch circuit board, parts location and wiring diagram (RT-246/VRC only).

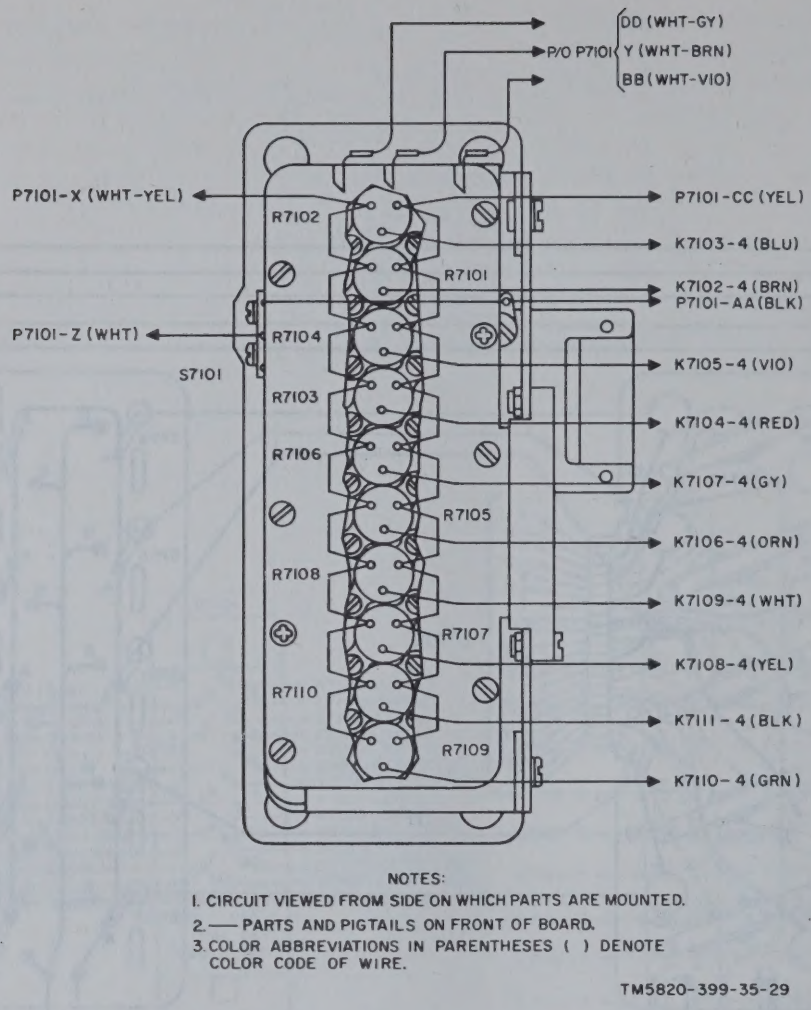


Figure 35. Assembly A7100 potentiometer circuit board, parts location and wiring diagram (RT-246/VRC only).

Section II. FOURTH ECHELON REPAIRS

49. General

Fourth echelon repair includes removal and replacement of the following: the main circuit board of assembly A6000, parts of assembly A7100 (RT-246/VRC only), the gear trains, power amplifier tuning capacitor C6217, the tube sockets, and parts of assembly A9000.

50. Removal and Replacement of Assembly A6000 Main Circuit Board (fig. 36)

a. Removal.

(1) Remove the receiver-transmitter front panel from the case (para 32).

(2) Remove assemblies A6300 and A6400 (para 38*a*).

(3) Unsolder the two leads connected to the two color-coded female connectors.

(4) Press the color-coded female connectors out of the chassis.

(5) Remove the screws that secure the main circuit board (fig. 50) to the A6000 chassis.

(6) Unsolder the ground lug in the center of the main circuit board (fig. 50).

(7) Lift out the main circuit board.

b. Replacement.

(1) Position the main circuit board in

the chassis and secure it with its screws.
(2) Solder the ground lug in the center of the main circuit board.
(3) Press the color-coded female connectors into the A6000 chassis.
(4) Solder the two leads to the two color-coded female connectors.
(5) Replace assemblies A6300 and A6400 (para 38).
(6) Replace the covers on assembly A6000.
(7) Replace the receiver-transmitter front panel (para 32).

51. Removal and Replacement of Assembly A9000 Parts

Figures 29, 30, and 31 give the locations of parts in assembly A9000.

a. Removal of Parts.
(1) Perform the procedures outlined in (TM 11-5820-401-20, para 17*e*(1)), except do not remove relays K9001 and K9002 unless it is necessary.
(2) Tag and unsolder the leads from the transformers and coils to the component circuit board.
(3) Remove the screws that secure the component circuit board, and remove the board.
(4) Remove any defective transformer or coil (para 45*e*).

b. Replacement of Parts.
(1) Replace the defective transformer or coil.
(2) Replace the component circuit board, solder the tagged leads, remove the tages, and secure the board with its screws.
(3) Swing the test circuit board into position and secure it with its screws.
(4) Replace assembly A9000 in the receiver-transmitter. (TM 11-5820-401-20, para 17*e*(2)).

52. Removal and Replacement of Power Amplifier Tuning Capacitor C6217 (fig. 24 and 25)

a. Removal.
(1) Tune the receiver-transmitter to 53.00 mc.
(2) Remove the heat exchanger from the receiver-transmitter case (para 34).
(3) Remove the screws that secure the power amplifier A6200 cover to the heat exchanger, and remove the cover.
(4) Remove the two screws that hold the ends of L6203 and L6206 to the two standoffs.
(5) Loosen the setscrews of the C6217 drive gear and its mating gear. Remove the C6217 drive gear. Note the angular position of the C6217 rotor plates.
(6) Remove the three screws that secure C6217 to the chassis.
(7) Remove C6217.
Note: Do not turn the C6217 rotor plates.

b. Replacement.
(1) Place the new capacitor, C6217, in the chassis and secure it with its screws.
(2) Set the new capacitor rotor plates to exactly the same angular position as the position of the old capacitor rotor plates. Replace the gear and tighten the gear setscrews.
(3) Replace the screws that secure the L6203 and L6206 to the two standoffs.
(4) Replace the power amplifier cover and secure it with its screws.
(5) Replace the heat exchanger in the receiver-transmitter case (para 34).
(6) Align the power amplifier (para 42).

53. Removal and Replacement of Tube Sockets XV6101 and XV6201 (fig. 22, 23, and 25)

a. Removal of XV6101.
(1) Remove the heat exchanger from the receiver-transmitter case (para 34*a*).
(2) Remove tube V6101 (TM 11-5820-401-20, para 14*a*(1)).
(3) Remove the bottom shield of assembly A6100.
(4) Tag and unsolder all the tube socket component.
(5) Note the orientation of the tube

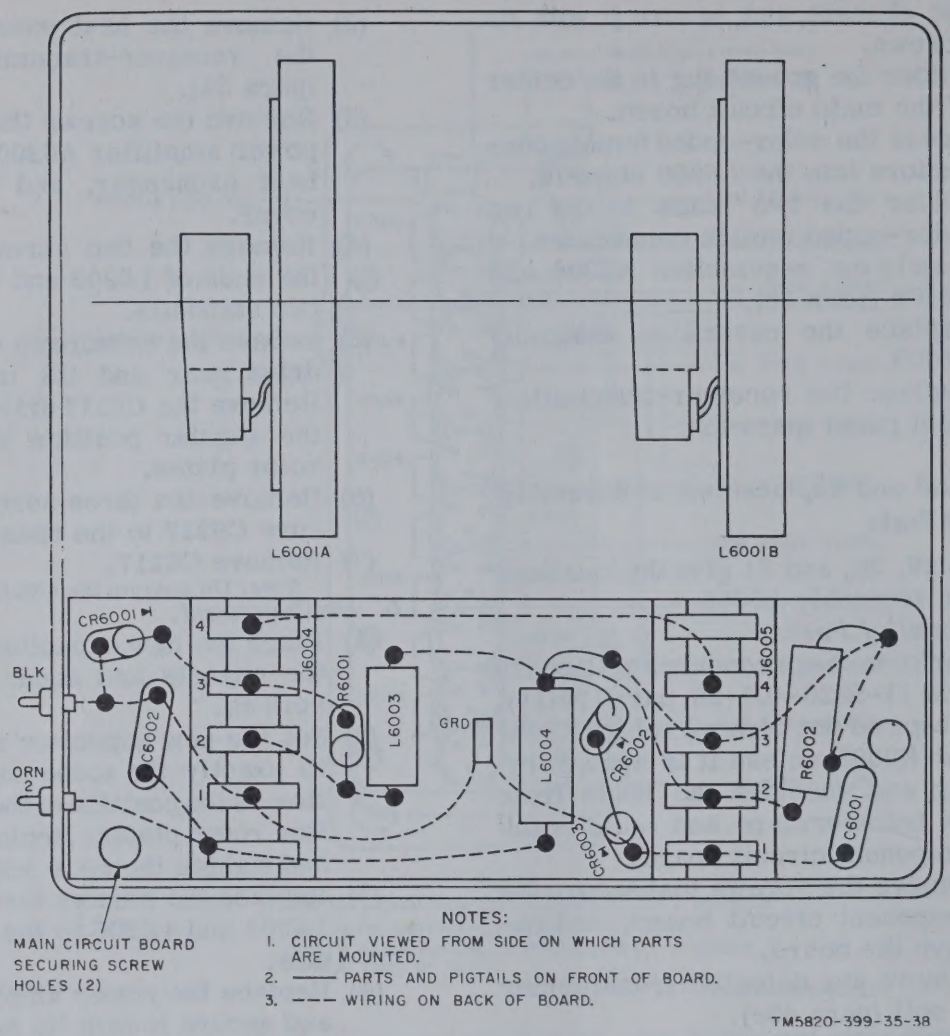


Figure 36. Assembly A6000 main circuit board (A6300 and A6400 removed), parts location and wiring diagram.

socket; unsolder the tube socket pins from the circuit board and remove the tube socket.

b. Replacement of XV6101.

(1) Orient the tube socket and insert it as noted in *a*(5) above.
(2) Solder the tube pins to the circuit board and the tagged components to the tube socket. Remove the tags.
(3) Replace the bottom shield of the A6100.
(4) Replace tube V6101 (TM 11-5820-401-20, para 14*a*(2)).
(5) Replace the heat exchanger in the receiver-transmitter case (para 34*c*).

c. Removal of XV6201.

(1) Remove the heat exchanger from the receiver-transmitter case (para 34*a*).
(2) Remove tube V6201 (TM 11-5820-401-20, para 14*b*(1)).
(3) Remove the securing screws from the two bottom covers of assembly A6200, and remove the covers.
(4) Tag and unsolder all the tube socket XV6201 components.
(5) Note the orientation of the XV6201. Remove the four XV6201 securing screws and remove the socket.

d. Replacement of XV6201.

(1) Orient the tube socket as noted in

c(5) above. Insert the tube socket and secure it with its four screws.

(2) Replace and solder all the tagged tube socket components. Remove the tags.

(3) Replace and secure the two bottom covers of the A6200.

(4) Replace tube V6201 (TM 11-5820-401-20, para 14*b*(2)).

(5) Replace the heat exchanger in the receiver-transmitter case (para 34*c*).

54. Parts Replacement in Assembly A7100 (RT-246/VRC Only) (fig. 17, 32, 33, and 34)

Disassembly and assembly requires three persons; two are required to hold the circuit boards against assembly spring pressure, while the third removes the eight screws that secure the top circuit board to the A7100. When the circuit boards have been removed, disassembly is obvious.

a. Removal.

(1) Remove the front panel (para 32).

(2) Remove assembly A7100 (para 33*d* (2)).

b. Replacement.

(1) Replace assembly A7100.

(2) Replace the front panel.

55. Removal and Replacement of Front-Panel Gear Train (fig. 17 (RT-246/VRC) and 21 (RT-524/VRC))

a. Removal.

(1) Remove the front panel (para 32).

(2) Remove assemblies A1000, A2000, and A6000 (para 33*a*, *c*, and *f*, respectively).

(3) Unsolder and disconnect the blade assembly wire.

(4) Dismount connector P301 (RT-246/VRC) or P352 (RT-524/VRC).

(5) Disconnect the leads to potentiometer R303 (RT-246/VRC), or remove switch S357 (RT-524/VRC).

(6) Remove the MC-TUNE-KC and the BAND knobs.

(7) Remove the four securing screws on the front-panel gear train housing.

(8) Turn the front panel face up while holding its gear train assembly in position. This will prevent parts within the gear train from falling out.

(9) Carefully lower the front-panel gear train assembly away from the front panel. Do not turn the front-panel gear train assembly over.

(10) If replacement of the dial glass is required, proceed as follows:

(a) Remove the mask and the gasket.

(b) Remove the dial glass and scrape the cement off the mating surface of the front panel.

(c) Apply a metal-to-glass cement to the mating surface of the front panel.

(d) Install the new dial glass; mount the new dial glass, the gasket, and the mask.

b. Replacement.

(1) Hold the front panel face up and carefully position the gear train assembly on it. Do not turn the gear train over. Check to be sure that the mc, kc, and band switch shafts mate with their respective holes in the front panel.

(2) Secure the front-panel gear train housing to the front panel with the four screws.

(3) Replace the MC-TUNE-KC and the BAND knobs.

(4) On the RT-524/VRC, replace switch S357.

(5) On the RT-246/VRC, connect the leads to potentiometer R303.

(6) Secure connector P301 (RT-246/VRC) or P352 (RT-524/VRC).

(7) Connect the wire to the blade assembly.

(8) Replace assemblies A1000, A2000, and A6000 (para 33*b*, *c*, and *f*, respectively).

(9) Replace the front panel (para 32).

56. Removal and Replacement of Intermediate Gear Train (fig. 61)

a. Removal.

(1) Remove the front panel (para 32).

(2) Remove the heat exchanger (para 34).

(3) Loosen the three clamps and dismount the band switch motor (23) and its gear (20) (RT-246/VRC only).

(4) Loosen the coupler setscrew and remove the coupler (45).

(5) Loosen the coupler setscrew and remove the coupler (42).

(6) Loosen the coupler setscrew and remove the coupler (43).

(7) Remove the four securing screws and washers and dismount the housing (46) from the receiver-transmitter case.

b. Replacement.

(1) Mount the housing (46) into the receiver-transmitter case and secure it with its four screws and washers.

(2) Slide the coupler (43) onto the shaft and tighten the setscrew to secure it.

(3) Slide the coupler (42) onto the shaft and tighten the setscrew to secure it.

(4) Slide the coupler (45) onto the shaft and tighten the setscrew to secure it.

(5) If the band switch motor gear (20) has been removed, reassemble it to the band switch motor (23), mount the band switch motor, and tighten the three clamps to secure it (RT-246/VRC only).

(6) Replace the heat exchanger (para 34).

(7) Replace the front panel (para 32).

CHAPTER 5

FOURTH ECHELON TESTING PROCEDURES

57. General

a. The testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service organizations responsible for fourth echelon maintenance of signal equipment to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that the transmitter portion of a repaired Receiver Transmitter, Radio RT-246/VRC or Receiver Transmitter, Radio RT-524/VRC *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for the testing of equipment at the third echelon if the proper tools and test equipments are available. A summary of the performance standards is given in paragraph 67.

b. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

58. Test Equipment, Tools, Materials, and Additional Equipment Required

a. General. All test equipment, tools, materials, and other equipment required to perform the testing procedures given in this section are listed in the following charts and are authorized under TA 11-17, Signal Field Maintenance Shops, and TA 11-100(11-17), Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States.

b. Special Requirements.

(1) Specific models of test equipment were used to perform the test procedures given in paragraphs 61 through 66. If these test procedures are performed with other models of the test equipments, allowance must be made for any test connection or test indication that may differ from those given in the test procedures.

(2) Unless otherwise specified, all tests are to be performed with the PP-1104A/G adjusted for 25.5 volts dc output.

(3) The electrical tests should be conducted in a well-shielded room such as Electromagnetic Shielding Inclosure MX-1761/G.

c. Test Equipment.

Nomenclature	Technical reference
Audio Oscillator TS-382F/U ----	TM 11-6625-261-12
Voltmeter, Electronic ME-30C/U	TM 11-6625-320-12
Frequency Meter AN/USM-26---	TM 11-5057
Power Supply PP-1104A/G -----	TM 11-5126
Radio Frequency Wattmeter AN/URM-43A.	TM 11-5133
Receiver, Radio R-442/VRC----	TM 11-5820-409-35
Signal Generator AN/URM-48---	TM 11-1257
Spectrum Analyzer TS-723B/U--	TM 11-5097

d. Additional Equipment.

Nomenclature
Electromagnetic Shielding Inclosure MX01761/G or equivalent.
Tool Kit TK-87/U.
Adapter UG-274B/U.
Cable Assembly, Radio Frequency CG-1773/U.
Microphone, Dynamic M-80/GR.
Resistor, 150 ohms ±5%, 2 watts.
Resistor, 600 ohms ±5%, 2 watts.
Special 50-ohm, 10-db pad (para 59*a*).
Test cable No. 1 (two required) (fig. 28).
Special wire antenna (para 59*b*).
Stopwatch.

59. Fabrication of Special 50-Ohm Pad and Special Wire Antenna

a. A special 50-ohm, 10-db pad is required to couple the output of the receiver-transmitter to the input of the R-442/VRC. Fabricate the special 50-ohm, 10-db pad as shown in figure 37.

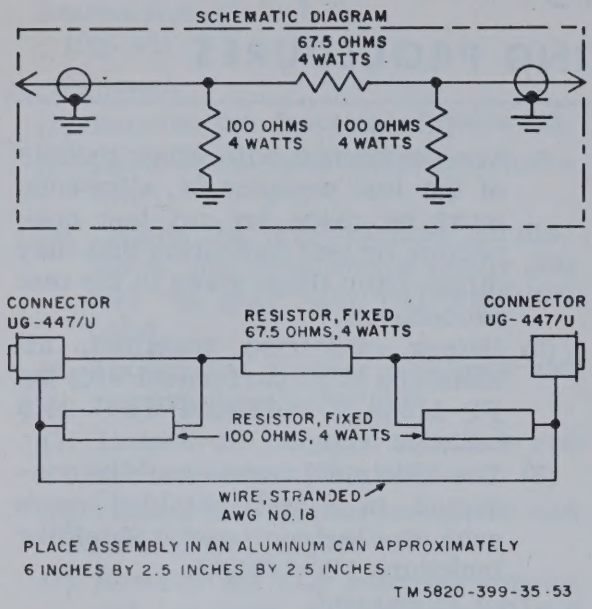


Figure 37. Special 50 ohm, 10-db pad, construction details.

b. A special wire antenna is required to couple radiofrequency energy from the transmitter to the receiver. Fabricate the special wire antenna as shown in figure 38.

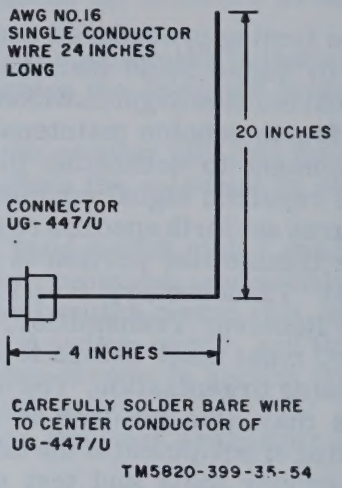


Figure 38. Special wire antenna, construction details.

			limits of travel. *d.* Push SQUELCH switch latch from left to right.	or excessive looseness. *d.* No looseness or damage evident.
3	N/A	Controls may be in any position.	*a.* Loosen captive screws securing assemblies A3000, A8000, and A4000, swing assemblies out on their hinges, and lock them by their braces. Inspect front panel and assemblies A1000, A6000, A3000, and A4000, and (A7000 RT-246/VRC) for loose or missing screws. *b.* Loosen captive screws securing assemblies A5000 and A9000 and remove assemblies. Inspect assemblies A5000, A2100, and A9000 for loose or missing screws. *c.* Inspect connections to assembly A2100 for looseness or damage.	*a.* Screws will be tight; none missing. *b.* Screws will be tight; none missing. *c.* No looseness or damage evident.
4	N/A	Controls may be in any position.	*a.* Remove the shields from the main circuit boards of assemblies A3000, A4000, A5000, and A8000. *b.* Loosen screws and hinge back plate on A9000. Inspect for loose or missing screws. Inspect coaxial connectors for looseness or damage. *c.* Inspect connections to assembly A2100 for looseness or damage.	*a.* Screws will be tight; none missing. Connectors will be undamaged and firmly seated. *b.* Same as *a* above. *c.* No looseness or damage evident.
5	N/A	N/A	Check the receiver-transmitter for applicable modification work orders.	None.

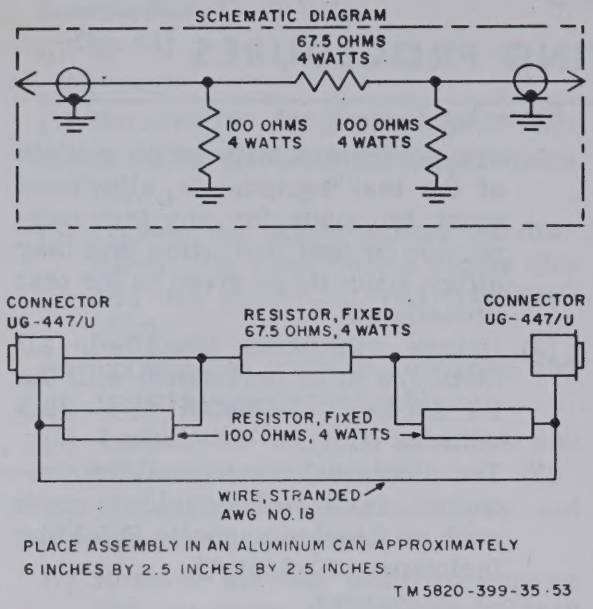


Figure 37. Special 50 ohm, 10-db pad, construction details.

b. A special wire antenna is required to couple radiofrequency energy from the transmitter to the receiver. Fabricate the special wire antenna as shown in figure 38.

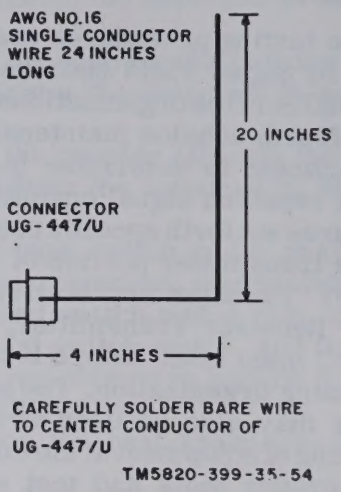


Figure 38. Special wire antenna, construction details.

60. Physical Tests and Inspection

a. Test Equipment and Materials None.

b. Test Connections and Conditions. Remove the top and bottom covers from the case. Remove the heat exchanger covers.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	N/A	Controls may be in any position.	*a.* Inspect all control and external assemblies for loose or missing screws. *b.* Inspect connectors and blower squirrel cage for looseness or damage. *c.* Inspect case and front panel for damage, missing parts, and condition of finish. *Note:* Touchup painting is recommended in lieu of refinishing wherever practicable. Screwheads and connectors will not be painted or polished with abrasives.	*a.* Screws will be tight; none missing. *b.* No looseness or damage evident. *c.* No damage or missing parts evident. Painted external surfaces will not show bare metal. Panel lettering will be legible.
2	N/A	Controls may be in any position.	*a.* Turn the following switches to each of their operating positions: BAND LIGHT POWER SQUELCH (latch pulled to left) SPEAKER (RT-524/VRC) *b.* Turn MC-TUNE-KC controls throughout their limits of travel. *Note:* KC-TUNE control will rotate through 360° *c.* Turn VOLUME control throughout its limits of travel. *d.* Push SQUELCH switch latch from left to right.	*a.* Switches operate freely, without binding or excessive looseness. *b.* Controls operate freely through detented positions. *c.* Control rotates freely, without binding or excessive looseness. *d.* No looseness or damage evident.
3	N/A	Controls may be in any position.	*a.* Loosen captive screws securing assemblies A3000, A8000, and A4000, swing assemblies out on their hinges, and lock them by their braces. Inspect front panel and assemblies A1000, A6000, A3000, and A4000, and (A7000 RT-246/VRC) for loose or missing screws. *b.* Loosen captive screws securing assemblies A5000 and A9000 and remove assemblies. Inspect assemblies A5000, A2100, and A9000 for loose or missing screws. *c.* Inspect connections to assembly A2100 for looseness or damage.	*a.* Screws will be tight; none missing. *b.* Screws will be tight; none missing. *c.* No looseness or damage evident.
4	N/A	Controls may be in any position.	*a.* Remove the shields from the main circuit boards of assemblies A3000, A4000, A5000, and A8000. *b.* Loosen screws and hinge back plate on A9000. Inspect for loose or missing screws. Inspect coaxial connectors for looseness or damage. *c.* Inspect connections to assembly A2100 for looseness or damage.	*a.* Screws will be tight; none missing. Connectors will be undamaged and firmly seated. *b.* Same as *a* above. *c.* No looseness or damage evident.
5	N/A	N/A	Check the receiver-transmitter for applicable modification work orders.	None.

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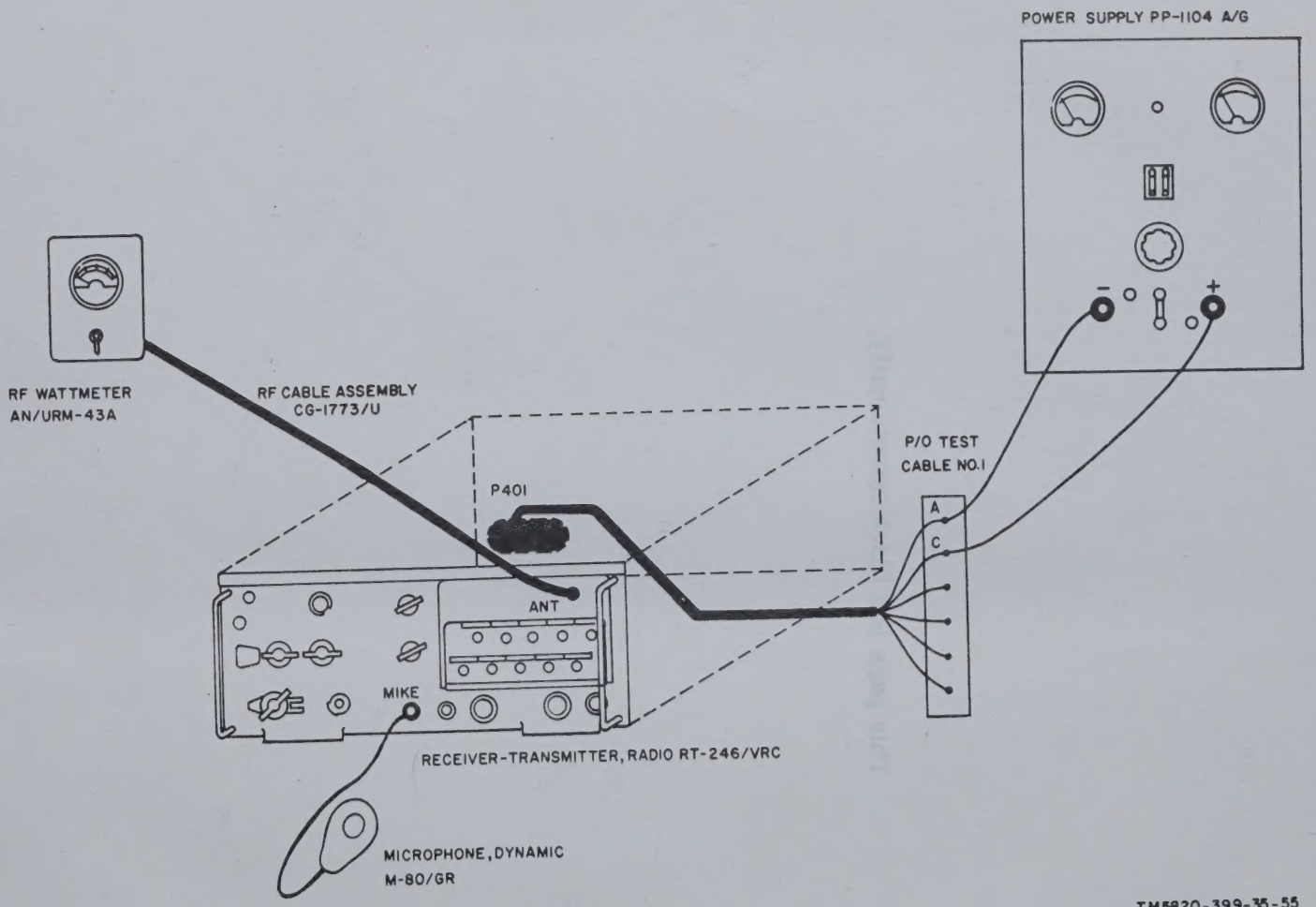

Figure 39. Receiver-transmitter rf power output test.

61. Receiver-transmitter Rf Power Output Test

a. Test Equipment and Materials.

(1) Cable Assembly, Radio Frequency CG-1773/U.
(2) Microphone, Dynamic M-80/GR.
(3) Power Supply PP-1104A/G.
(4) Radio Frequency Wattmeter AN/URM-43A.
(5) Test Cable No. 1 (fig. 28).

b. Test Connections and Conditions. Connect the equipment as shown in figure 39. Turn on the equipment and allow it to warm up for 1 minute.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*AN/URM-43A:* 15W-60W switch: 15W. *PP-1104 A/G:* INCREASE VOLTAGE knob adjusted for 23 volt output.	*RT-246/VRC or RT-524/VRC:* LIGHT: ON BAND: A MC-TUNE-KC: 30.00 mc. POWER: LOW SQUELCH: OLD OFF VOLUME: maximum counterclockwise. SPEAKER: OFF (RT-524/VRC only).	*a.* Press push-to-talk switch on M-80/GR. Note AN/URM-43A meter indication. Release push-to-talk switch. *b.* Turn INCREASE VOLTAGE knob of PP-1104A/G to obtain a 25.5 volt output. *c.* Press push-to talk switch on M-80/GR. Note AN/URM-43A meter indication. Release push-to-talk switch. *d.* Turn INCREASE VOLTAGE knob of PP-1104A/G to obtain a 30-volt output. *e.* Press push-to-talk switch on M-80/GR. Note AN/URM-43A meter indication, and then release push-to-talk switch.	*a.* AN/URM-43A meter must indicate between 1 and 4 watts. *b.* None. *c.* Same as *a* above. *d.* None. *e.* Same as *a* above.
2	*AN/URM-43A:* 15W-60W switch: 60W. *PP-104A/G:* INCREASE VOLTAGE knob adjusted for 23 volt output.	Same as step 1 above except: POWER: HIGH	Same as step 1 above.	AN/URM-43A must indicate 35 watts minimum in *a*, *c*, and *e* of step 1 above.
3.	Same as step 1 above.	Same as step 1 above.	Repeat step 1 above for frequencies of 42.00 and 52.00 mc on BAND A, and 53.00, 65.00, and 75.95 mc on BAND B.	Same as step 1 above.
4	Same as step 2 above.	Same as step 1 above except: POWER: HIGH	Repeat step 1 above for frequencies of 42.00 and 52.00 mc on BAND A, and 53.00, 65.00, and 75.95 mc on BAND B.	AN/URM-43A must indicate 35 watts minimum in *a*, *c*, and *e* of step 1 above.

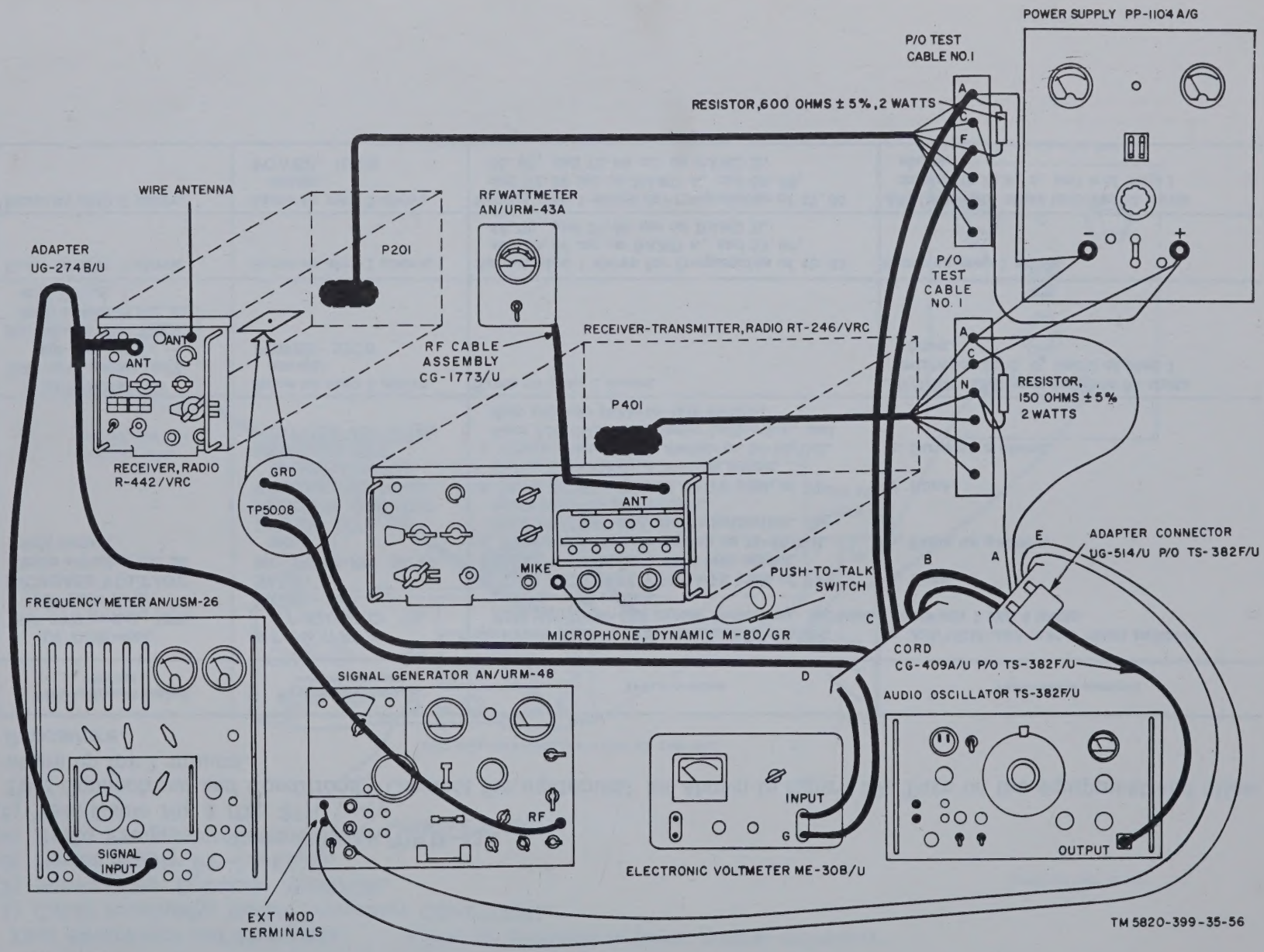

Figure 40. Receiver-transmitter frequency, squelch deviation, ana deviation-limiting test.

	VOLTS: 10K			
3	Same as in step No. 1 except: *R-442/VRC* SQUELCH: NEW ON	As last indicated except: *RT-246/VRC or RT-524/VRC:* SQUELCH: NEW ON	*a.* Reconnect ME-30B/U as in D in figure 40. *b.* Press M-80/GR the push-to-talk switch. *c.* Note CALL indicator on R-442/VRC. *d.* Note and record ME-30B/U ac indication. *e.* Release M-80/GR push-to-talk switch. *f.* Turn RT-246/VRC or RT-524/VRC POWER switch to OFF BREAKER-RESET.	*a.* None. *b.* None. *c.* CALL indicator lights. *d.* None. *e.* None. *f.* None.
4	Same as in step No. 1 except: *TS-382F/U:* FREQUENCY MULTIPLIER: X1 Frequency dial: 150 *R-442/VRC:* SQUELCH: NEW ON *AN/USM-26:* TIME UNIT: EXT FUNCTION SELECTOR: FREQUENCY FREQUENCY UNIT: 1 RANGE-MC: 40-100 MIXING FREQUENCY MCS: 60 TUNING: 60 GAIN: MAX *AN/URM-48:* BAND SWITCH: D RF TUNING: 60 MEGACYCLES DEVIATION RANGE: 25 OPERATION: EXT MOD DEVIATION LEVEL: counterclockwise RF SET TO LINE: right-hand meter to redline RF ATTENUATOR MICROVOLTS: 10K	As last indicated.	*a.* Reconnect TS-382F/U as in E in figure 40. *b.* Adjust AN/URM-26 TUNING control to close eye. *c.* Adjust AN/URM-48 RF TUNING control for 60.05-mc indication on AN/USM-26. *d.* Turn AN/USM-48 RF ATTENUATOR MICROVOLTS control to indicated 1.12 uv. *e.* Slowly adjust AN/URM-48 DEVIATION LEVEL control until ME-30B/U indicates same value recorded in step No. 3 (*d* above). Note deviation indicated on KILOCYCLES DEVIATION meter of AN/URM-48.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* AN/URM-48 deviation indication is 2.5 to 3.5 kc.
5	Same as in step No. 1 except: *ME-30B/U:* Range selector switch: 3 volts	Same as in step No. 1.	*a.* Connect TS-382F/U output as in A in figure 40. *b.* Connect ME-30B/U as in figure 40B. Do not disconnect TS-382F/U. *c.* Adjust TS-382F/U for 1.1-volt ME-30-B/U indication. *d.* Reconnect ME-30B/U as in C in figure 40. Maintain VOLUME control setting of that in step No. 1*f* above.	*a.* None. *b.* None. *c.* None. *d.* ME-30B/U indication must be less than 14.1 volts (less than 3-db increase).

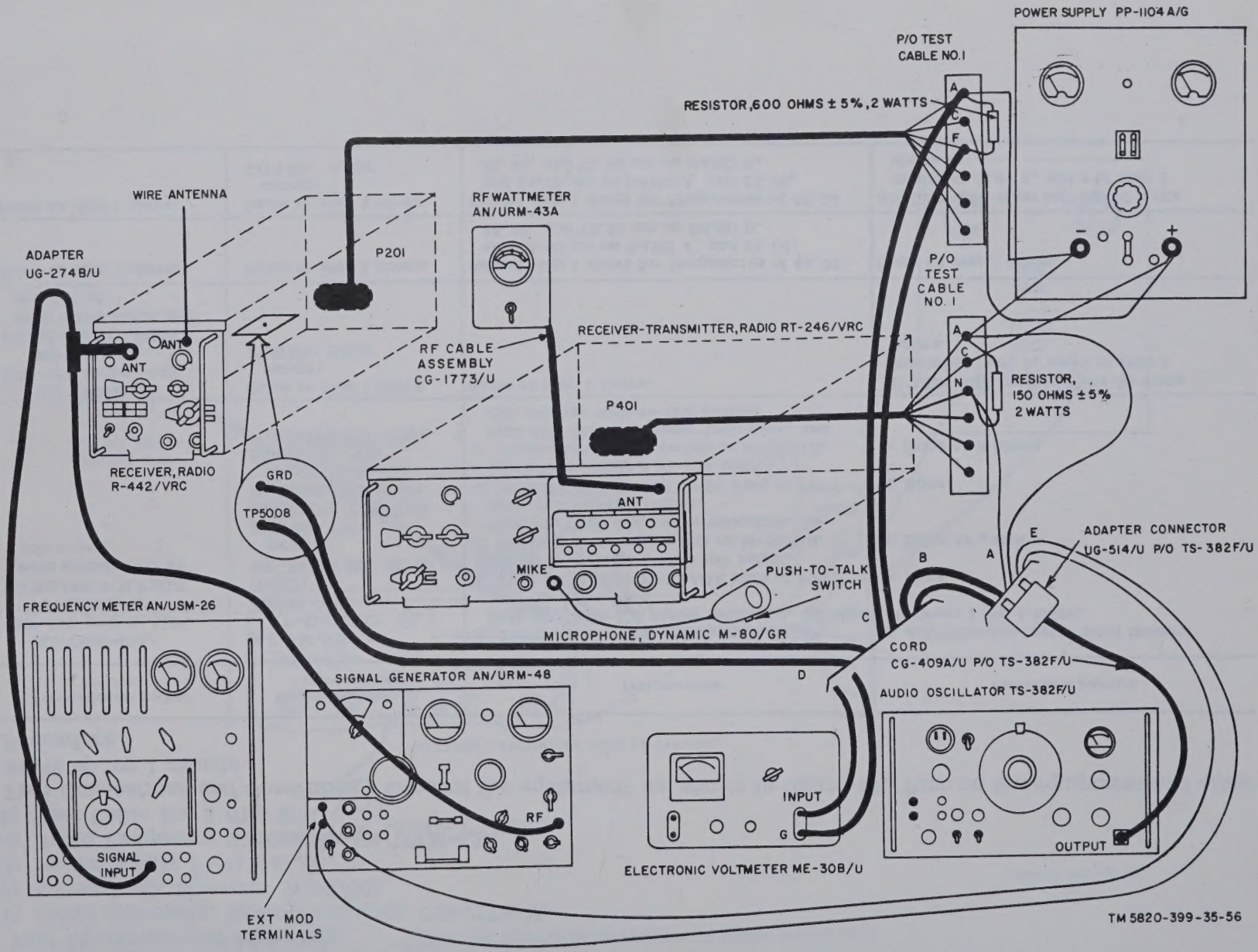

Figure 40. Receiver-transmitter frequency, squelch deviation, ana deviation-limiting test.

62. Receiver-transmitter Frequency, Squelch Deviation, and Deviation-Limiting Test

a. Test Equipment and Materials.

(1) Audio Oscillator TS-382F/U.
(2) Cable Assembly, Radio Frequency CG-1773/U.
(3) Voltmeter, Electronic ME-30B/U.
(4) Frequency Meter AN/USM-26 (Frequency Meter FR-38D/U with Frequency Converter Unit MX-1637/U installed).
(5) Microphone, Dynamic M-80/GR.
(6) Power Supply PP-1104A/G.
(7) Radio Frequency Wattmeter AN/URM-43A.
(8) Receiver, Radio R-442/VRC.
(9) Signal Generator AN/URM-48.
(10) Adapter UG-274B/U.
(11) Resistor, 150 ohms ±5%, 2 watts.
(12) Resistor, 600 ohms ±5%, 2 watts.
(13) Test cable No. 1 (two required).
(14) Special wire antenna.

b. Test Connections and Conditions. Connect the equipment as shown in figure 40. The letters A through E in figure 40 refer to connection directions in the *Test procedure* column. Remove the top cover of R-442/VRC, release assembly A3000, and swing it out to expose assembly A5000. Turn on the equipment and allow it to warm up for 5 minutes.

c. Procedure.

Step No.	Test equipment control setting	Equipment under test control settings	Test procedures	Performance standard
1	*TS-382F/U:* FREQUENCY MULTIPLIER: X10 Frequency dial: 100 OUTPUT MULTIPLIER: X1 OUTPUT CONTROL: counterclockwise *ME-30B/U:* Range selector switch: .3 VOLTS *AN/URM-43A* 15W-60W: 15W *R-442/VRC:* BAND: B LIGHT: ON MC-TUNE-KC: 60.05 mc SQUELCH: OLD ON VOLUME: counterclockwise POWER: ON-RESET	*RT-246/VRC or RT-524/VRC:* LIGHT: ON BAND: B MC-TUNE-KC: 60.05 mc POWER: LOW SQUELCH: OLD ON VOLUME: counterclockwise SPEAKER: OFF (RT-524/VRC)	*a.* Connect TS-382F/U output as in A in figure 40. *b.* Connect ME-30B/U as in B in figure 40. Do not disconnect TS-382F/U. *c.* Adjust TS-382F/U OUTPUT CONTROL for 0.22-volt ME-30B/U indication. *d.* Reconnect ME-30B/U (with its range selector switch on 30) as in C in figure 40. Do not disconnect TS-382F/U. *e.* Press M-80/GR push-to-talk switch. *f.* Adjust R-442/VRC VOLUME control for indication of 10 volts on ME-30B/U. Release M-80/GR push-to-talk switch. Maintain this setting in steps 2 through 5. *g.* Turn RT-246/VRC or RT-524/VRC POWER control to OFF BREAKER-RESET.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* None.
2	Leave controls in position last indicated in step No. 1. *AN/USM-26:* TIME UNIT: EXT FUNCTION SELECTOR: FREQUENCY FREQUENCY UNIT: 1 RANGE-MC: 40-100 MIXING FREQUENCY MCS: 60 TUNING: 60 GAIN: MAX *AN/URM-48:* BAND SWITCH: D RF TUNING: 60 MEGACYCLES DEVIATION RANGE: 25 OPERATION: 1000 (cps) DEVIATION LEVEL: counterclockwise RF SET TO LINE: right-hand meter to redline RF ATTENUATOR MICROVOLTS: 10K	As last indicated.	*a.* Adjust AN/USM-26 TUNING control to close eye. *b.* Adjust AN/URM-48 RF TUNING control for 60.05-mc indication on AN/USM-26. *c.* Turn AN/URM-48 RF ATTENUATOR MICROVOLTS control to indicated 11.6 uv. *d.* Slowly advance AN/URM-48 DEVIATION LEVEL control until ME-30B/U indicates 10 volts. Note deviation indicated on KILOCYCLES DEVIATION meter of AN/URM-48.	*a.* None. *b.* None. *c.* None. *d.* AN/URM-48 deviation indication should be 6 to 10 kc.
3	Same as in step No. 1 except: *R-442/VRC* SQUELCH: NEW ON	As last indicated except: *RT-246/VRC or RT-524/VRC:* SQUELCH: NEW ON	*a.* Reconnect ME-30B/U as in D in figure 40. *b.* Press M-80/GR the push-to-talk switch. *c.* Note CALL indicator on R-442/VRC. *d.* Note and record ME-30B/U ac indication. *e.* Release M-80/GR push-to-talk switch. *f.* Turn RT-246/VRC or RT-524/VRC POWER switch to OFF BREAKER-RESET.	*a.* None. *b.* None. *c.* CALL indicator lights. *d.* None. *e.* None. *f.* None.
4	Same as in step No. 1 except: *TS-382F/U:* FREQUENCY MULTIPLIER: X1 Frequency dial: 150 *R-442/VRC:* SQUELCH: NEW ON *AN/USM-26:* TIME UNIT: EXT FUNCTION SELECTOR: FREQUENCY FREQUENCY UNIT: 1 RANGE-MC: 40-100 MIXING FREQUENCY MCS: 60 TUNING: 60 GAIN: MAX *AN/URM-48:* BAND SWITCH: D RF TUNING: 60 MEGACYCLES DEVIATION RANGE: 25 OPERATION: EXT MOD DEVIATION LEVEL: counterclockwise RF SET TO LINE: right-hand meter to redline RF ATTENUATOR MICROVOLTS: 10K	As last indicated.	*a.* Reconnect TS-382F/U as in E in figure 40. *b.* Adjust AN/URM-26 TUNING control to close eye. *c.* Adjust AN/URM-48 RF TUNING control for 60.05-mc indication on AN/USM-26. *d.* Turn AN/USM-48 RF ATTENUATOR MICROVOLTS control to indicated 1.12 uv. *e.* Slowly adjust AN/URM-48 DEVIATION LEVEL control until ME-30B/U indicates same value recorded in step No. 3 (*d* above). Note deviation indicated on KILOCYCLES DEVIATION meter of AN/URM-48.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* AN/URM-48 deviation indication is 2.5 to 3.5 kc.
5	Same as in step No. 1 except: *ME-30B/U:* Range selector switch: 3 volts	Same as in step No. 1.	*a.* Connect TS-382F/U output as in A in figure 40. *b.* Connect ME-30B/U as in figure 40B. Do not disconnect TS-382F/U. *c.* Adjust TS-382F/U for 1.1-volt ME-30-B/U indication. *d.* Reconnect ME-30B/U as in C in figure 40. Maintain VOLUME control setting of that in step No. 1*f* above.	*a.* None. *b.* None. *c.* None. *d.* ME-30B/U indication must be less than 14.1 volts (less than 3-db increase).

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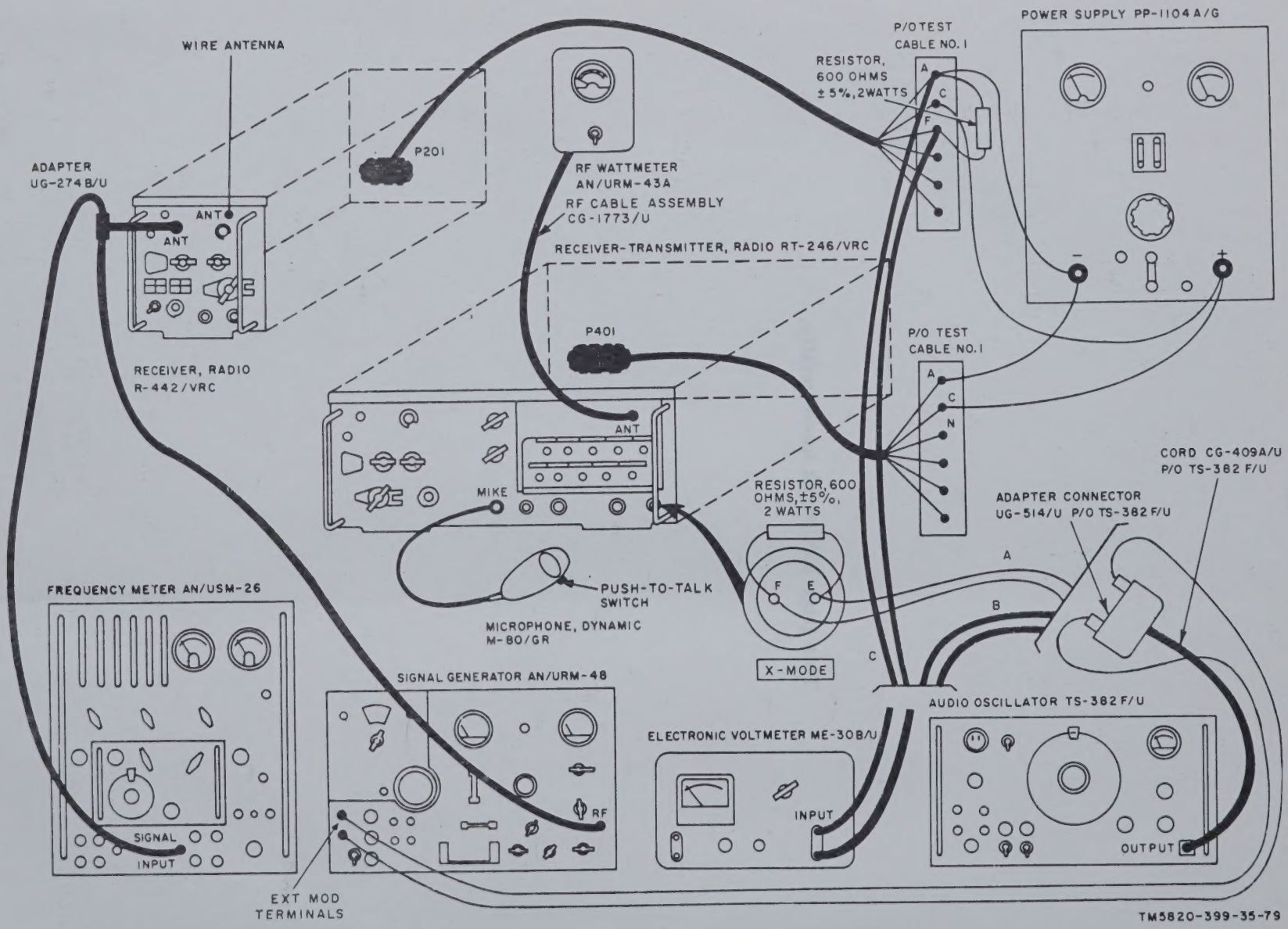


Figure 41. Receiver-transmitter wide-band deviation test.

	FREQUENCY UNIT: 1 RANGE-MC: 40-100 MIXING FREQUENCY MCS: 60 TUNING: 60 GAIN: MAX *AN/URM-48:* BAND SWITCH: D RF TUNING: 60 MEGACYCLES DEVIATION RANGE: 25 OPERATION: 1000 cps DEVIATION LEVEL: counterclockwise RF SET TO LINE: right-hand meter to redline RF ATTENUATOR MICROVOLTS: 10K		dv. *d.* Slowly advance AN/URM-48 DEVIATION LEVEL control until ME-30B/U indicates 10 volts. Note deviation indicated on KILOCYCLES DEVIATION meter of the AN/URM-48.	*d.* AN/URM-48 deviation indication is 6 to 10 kc.
3	Same as step No. 1, except: *ME-30B/U:* Range selector switch: 3 VOLTS	Same as step No. 1	*a.* Perform *a*, *b*, *c*, of step 1 above. *b.* Adjust TS-382F/U OUTPUT CONTROL for 2.45-volt indication on ME-30B/U. *c.* With R-442/VRC VOLUME control adjusted as in step No. 1 (*f* above), record ME-30B/U voltage indication.	*b.* None. *c.* None.
4	Same as steps No. 2 and 3.	Same as step No. 3	*a.* Perform *a*, *b*, and *c* of step 2 above. *b.* Slowly advance AN/URM-48 DEVIATION LEVEL until ME-30B/U indicates the same level recorded in step No. 3*c* above.	*a.* None. *b.* Deviation indicated is form 19 to 25 kc.

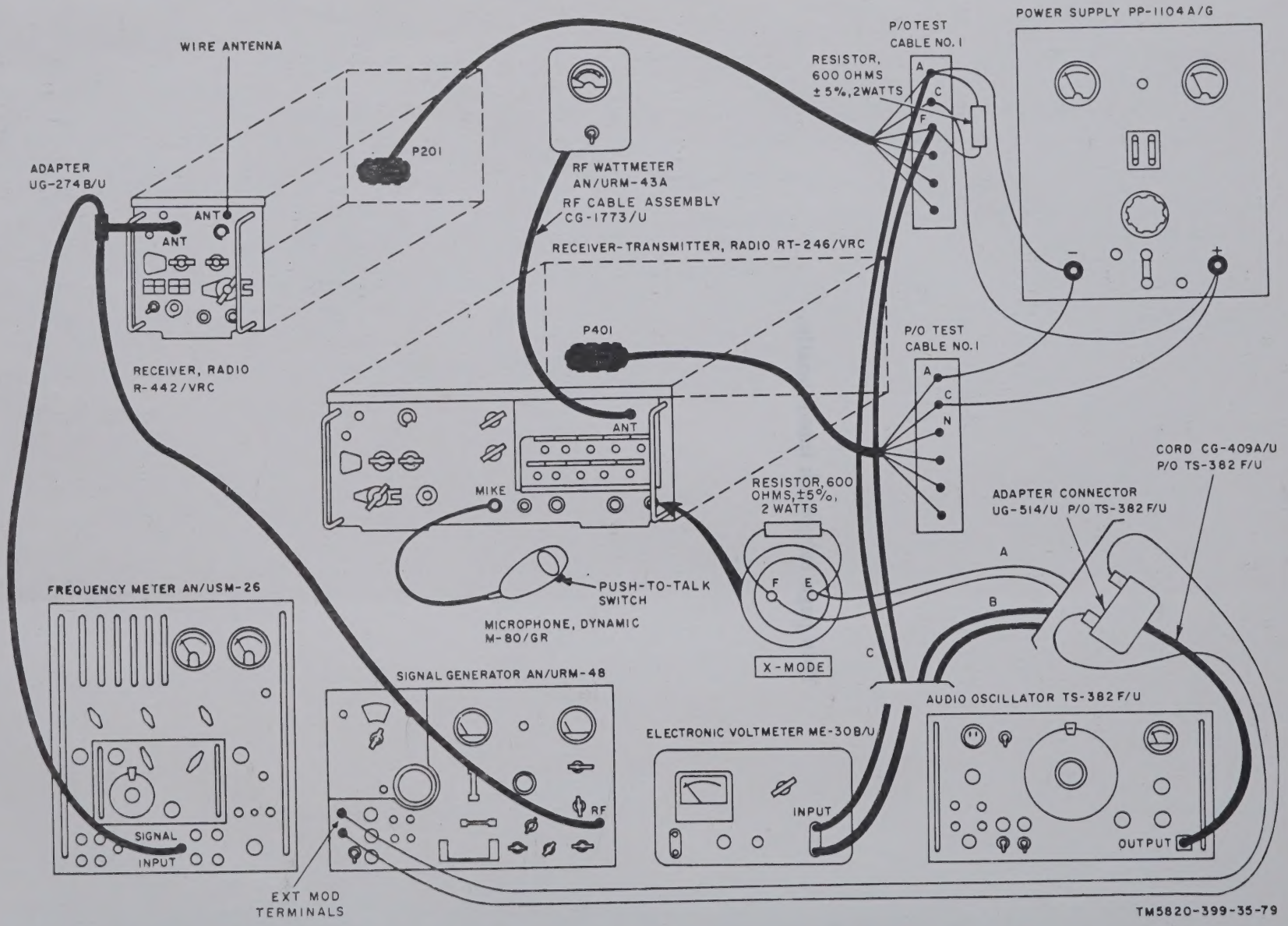


Figure 41. Receiver-transmitter wide-band deviation test.

63. Transmitter Wide-Band Deviation Test

Perform this test in a screen room such as Electromagnetic Shielding Inclosure MX-1761/G or equivalent.

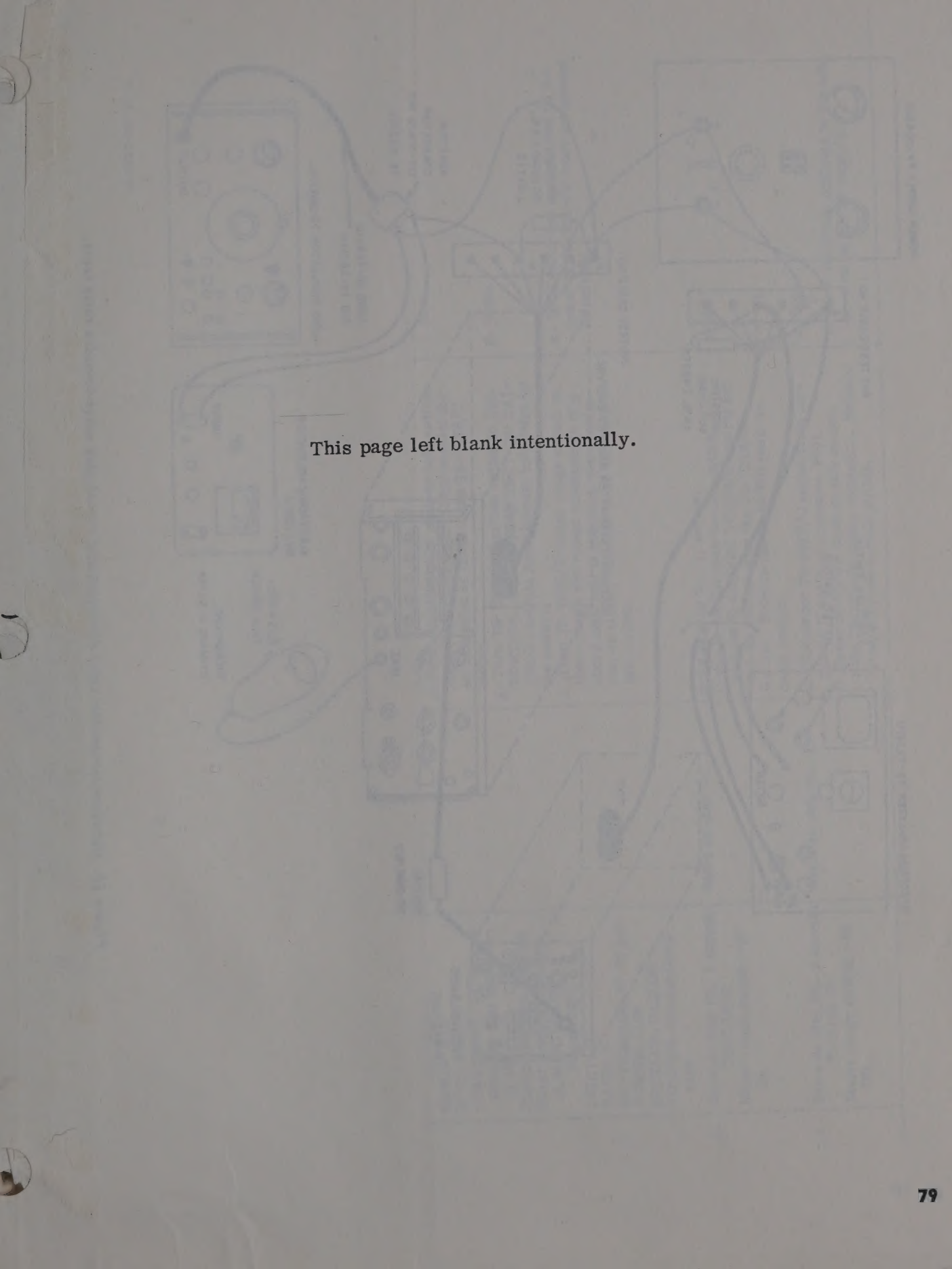
a. Test Equipment and Materials.

Audio Oscillator TS-382F/U
Cable Assembly, Radio Frequency CG-1773/U
Voltmeter, Electronic ME-30B/U
Frequency Meter AN/USM-26 (Frequency Meter FR-38D/U with Frequency Converter Unit MX-1637/U installed).
Microphone, Dynamic M-80/GR
Power Supply PP-1104A/G
Radio Frequency Wattmeter AN/URM-43A
Receiver, Radio R-442/VRC
Signal Generator AN/URM-48
Adapter UG-274B/U
Resistors, 600 ohms ±5 percent, 2 watts (2 required)
Test cable No. 1 (2 required)
Special wire antenna

b. Test Connections and Conditions. Connect equipment as shown in figure 41. The letters A and B of figure 41 refer to connection directions in the "Test procedure" column. Make sure that filters FL4001 and FL4002 are in WIDE BAND OPERATION position, that X-MODE-NORMAL switch S4001 is in the X-MODE position, and that connector P303 (P353) is removed. Turn on the equipment and allow it to warm up for 5 minutes.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS-382F/U:* FREQUENCY MULTIPLIER: X10 Frequency dial: 100 OUTPUT MULTIPLIER: X1 OUTPUT CONTROL: counterclockwise *ME-30B/U:* Range selector switch: 1 VOLT *AN/URM-43A* 15W-60W: 15W *R-442/VRC:* BAND: B LIGHT: ON MC-TUNE-KC: 60.05 mc SQUELCH: OLD ON VOLUME: counterclockwise POWER: ON-RESET	*RT-246/VRC or RT-524/VRC:* LIGHT: ON BAND: B MC-TUNE-KC: 60.05 mc POWER: LOW SQUELCH: OLD ON VOLUME: counterclockwise SPEAKER: OFF (RT-524/VRC)	*a.* Connect TS-382F/U output connector as in A, figure 41. *b.* Connect ME-30B/U as in B, figure 41. Do not disconnect TS-382F/U. *c.* Adjust TS-382F/U OUTPUT CONTROL for 0.773-volt ME-30B/U indication. *d.* Connect ME-30B/U (with its range selector switch on 30) as in C, figure 41. *e.* Press M-80/GR push-to-talk switch. *f.* Adjust R-442/VRC VOLUME control for an indication of 10 volts on the ME-30B/U and release M-80/GR push-to-talk switch. Maintain this setting in steps 2 through 4. *g.* Turn RT-246/VRC or RT-524/VRC POWER control to OFF-BREAKER RESET.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* None. *g.* None.
2	Same as in step No. 1, except: *AN/USM-26:* TIME UNIT: EXT FUNCTION SELECTOR: FREQUENCY FREQUENCY UNIT: 1 RANGE-MC: 40-100 MIXING FREQUENCY MCS: 60 TUNING: 60 GAIN: MAX *AN/URM-48:* BAND SWITCH: D RF TUNING: 60 MEGACYCLES DEVIATION RANGE: 25 OPERATION: 1000 cps DEVIATION LEVEL: counterclockwise RF SET TO LINE: right-hand meter to redline RF ATTENUATOR MICROVOLTS: 10K	Same as in step No. 1	*a.* Adjust AN/USM-26 TUNING control to close eye. *b.* Adjust AN/URM-48 RF TUNING control for 60.05-mc indication on the AN/USM-26. *c.* Turn AN/URM-48 RF ATTENUATOR MICROVOLTS control to an indicated 11.6 uv. *d.* Slowly advance AN/URM-48 DEVIATION LEVEL control until ME-30B/U indicates 10 volts. Note deviation indicated on KILOCYCLES DEVIATION meter of the AN/URM-48.	*a.* None. *b.* None. *c.* None. *d.* AN/URM-48 deviation indication is 6 to 10 kc.
3	Same as step No. 1, except: *ME-30B/U:* Range selector switch: 3 VOLTS	Same as step No. 1	*a.* Perform *a*, *b*, *c*, of step 1 above. *b.* Adjust TS-382F/U OUTPUT CONTROL for 2.45-volt indication on ME-30B/U. *c.* With R-442/VRC VOLUME control adjusted as in step No. 1 (*f* above), record ME-30B/U voltage indication.	*b.* None. *c.* None.
4	Same as steps No. 2 and 3.	Same as step No. 3	*a.* Perform *a*, *b*, and *c* of step 2 above. *b.* Slowly advance AN/URM-48 DEVIATION LEVEL until ME-30B/U indicates the same level recorded in step No. 3c above.	*a.* None. *b.* Deviation indicated is form 19 to 25 kc.



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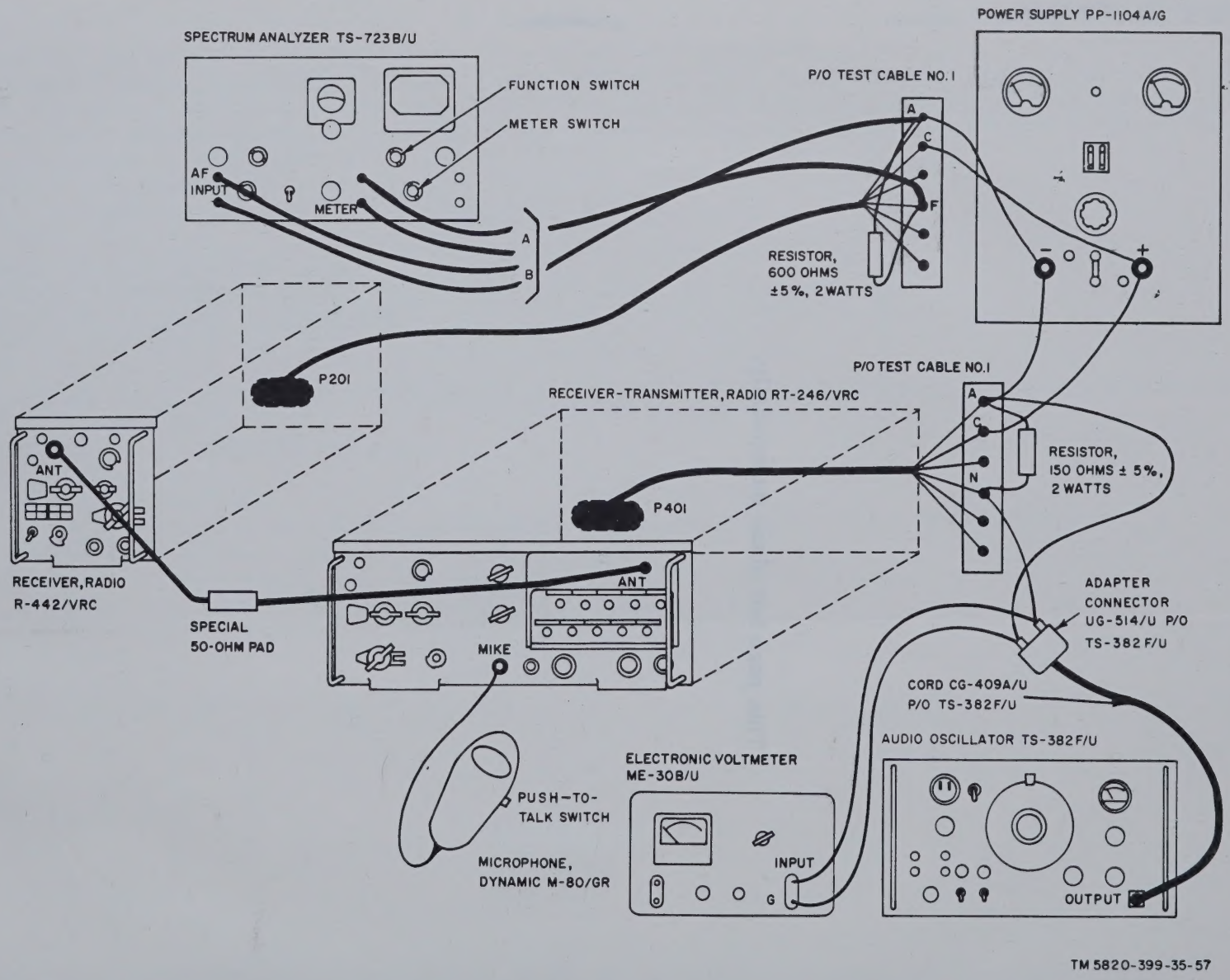

Figure 42. Receiver-transmitter total distortion and signal plus noise-to-noise ratio tests.

	TS-723B/U: RANGE: X10 INPUT: MIN FREQUENCY: adjust controls for dial indication of 100. Function switch: METER Meter range switch: 30 R.M.S. VOLTS *R-442/VRC:* LIGHT: ON BAND: B MC-TUNE-KC: 60.05 mc POWER: LOW SQUELCH: OLD ON VOLUME: counterclockwise		100%. *f.* Press the M-80/GR push-to-talk switch. Adjust the TS-723B/U INPUT control for an indication of 100% on the TS-723B/U meter. *g.* Turn TS-723B/U function switch to DISTORTION. Adjust FREQUENCY and BALANCE controls for minimum indication on the meter. *h.* Turn TS-723B/U meter range switch to lower range and repeat adjustments of *g* above until null is obtained. Note indication on meter. Release M-80/GR push-to-talk switch.	*f.* None. *g.* None. *h.* Total distortion as indicated on the meter of TS-723B/U must not exceed 10 percent.
2	Same as step No. 1 except: *TS-723B/U:* Meter range switch: +20 DB	Same as step No. 1.	Same as step No. 1, except: Press M-80/GR push-to-talk switch. Adjust the R-442/VRC VOLUME control for a 0-db indication on the TS-723B/U meter. Release the M-80/GR push-to-talk switch.	None.
3	Same as step No. 2 except: *TS-723B/U:* Meter range switch: -10 DB	Same as step No. 1.	*a.* Disconnect TS-382F/U output from terminals N and A of connector P401. *b.* Press M-80/GR push-to-talk switch. Note TS-723B/U meter indication. Release M-80/GR push-to-talk switch.	*a.* None. *b.* 35 db minimum (indicate to the left of -5 db on the TS-723B/U.

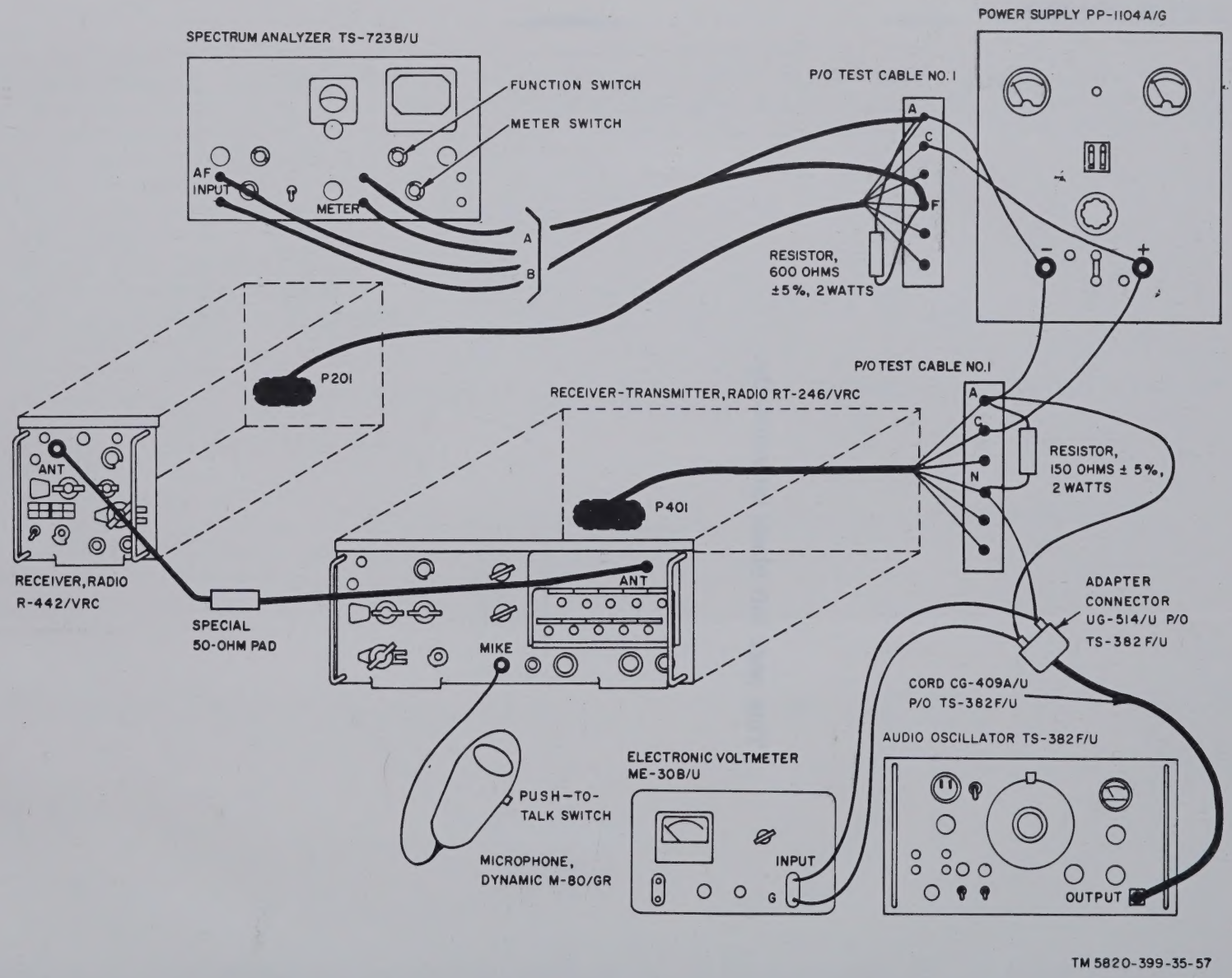

Figure 42. Receiver-transmitter total distortion and signal plus noise-to-noise ratio tests.

64. Transmitter Total Distortion and Signal Plus Noise-to-Noise Ratio Tests

Perform these tests in a screen room such as Electromagnetic Shielding Inclosure MX-1761/G or equivalent.

a. Test Equipment and Materials.

Audio Oscillator TS-382F/U
Voltmeter, Electronic ME-30B/U
Microphone, Dynamic M-80/GR
Power Supply PP-1104/AG
Receiver, Radio R-442/VRC
Spectrum Analyzer TS-723B/U
Resistor, 150 ohms ±5 percent, 2 watts
Resistor, 600 ohms, ±5 percent, 2 watts
Special 50-ohm pad (fig. 53)
Test cable No. 1 (2 required)

b. Test Conditions and Connections. Connect the equipment as shown in figure 42 and allow it to warm up for 5 minutes. The letters A and B, figure 42 refer to connection directions in the "Test procedures" column (below).

c. Procedure.

Step	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS-382F/U:* FREQUENCY MULTIPLIER: X10 Frequency dial: 100 OUTPUT MULTIPLIER: X1 OUTPUT CONTROL: counterclockwise *ME-30B/U:* Range selection switch: .3 volts *TS-723B/U:* RANGE: X10 INPUT: MIN FREQUENCY: adjust controls for dial indication of 100. Function switch: METER Meter range switch: 30 R.M.S. VOLTS *R-442/VRC:* LIGHT: ON BAND: B MC-TUNE-KC: 60.05 mc POWER: LOW SQUELCH: OLD ON VOLUME: counterclockwise	*RT-246/VRC or RT-524/VRC:* LIGHT: ON BAND: B MC-TUNE-KC: 60.05 mc POWER: LOW SQUELCH: OLD ON VOLUME: counterclockwise SPEAKER: OFF (RT-524/VRC)	*a.* Adjust TS-382F/U OUTPUT CONTROL for 0.22-volt indication on ME-30B/U. *b.* Connect TS-723B/U as in A, figure 42. *c.* Press the M-80/GR push-to-talk switch. Adjust the R-442/VRC VOLUME control for a TS-723B/U meter indication of 17.3 volts (500 milliwatts). Release the M-80/GR push-to-talk switch. *d.* Connect TS-723B/U as in B, figure 42. *e.* Turn the TS-723B/U FUNCTION switch to SET LEVEL and the meter range switch to 100%. *f.* Press the M-80/GR push-to-talk switch. Adjust the TS-723B/U INPUT control for an indication of 100% on the TS-723B/U meter. *g.* Turn TS-723B/U function switch to DISTORTION. Adjust FREQUENCY and BALANCE controls for minimum indication on the meter. *h.* Turn TS-723B/U meter range switch to lower range and repeat adjustments of *g* above until null is obtained. Note indication on meter. Release M-80/GR push-to-talk switch.	*a.* None. *b.* None. *c.* The R-442/VRC is now set up as a calibrated test instrument. *d.* None. *e.* None. *f.* None. *g.* None. *h.* Total distortion as indicated on the meter of TS-723B/U must not exceed 10 percent.
2	Same as step No. 1 except: *TS-723B/U:* Meter range switch: +20 DB	Same as step No. 1.	Same as step No. 1, except: Press M-80/GR push-to-talk switch. Adjust the R-442/VRC VOLUME control for a 0-db indication on the TS-723B/U meter. Release the M-80/GR push-to-talk switch.	None.
3	Same as step No. 2 except: *TS-723B/U:* Meter range switch: -10 DB	Same as step No. 1.	*a.* Disconnect TS-382F/U output from terminals N and A of connector P401. *b.* Press M-80/GR push-to-talk switch. Note TS-723B/U meter indication. Release M-80/GR push-to-talk switch.	*a.* None. *b.* 35 db minimum (indicate to the left of -5 db on the TS-723B/U.

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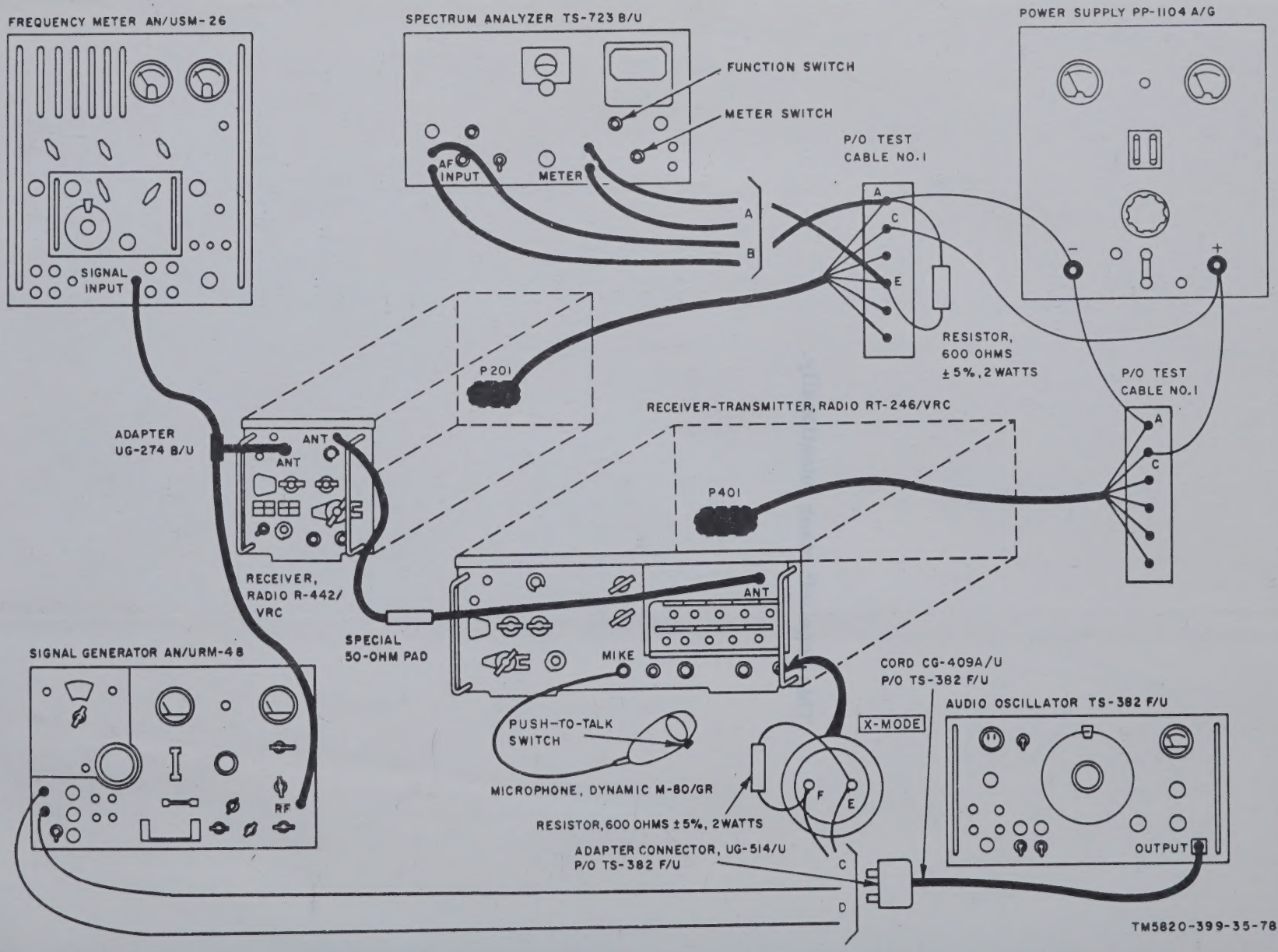


Figure 43. Receiver-transmitter wide-band total distortion test.

65. Transmitter Wide-Band Total Distortion Test

Perform this test in a screen room such as Electromagnetic Shielding Inclosure MX-1761/G or equivalent.

a. Test Equipment and Materials.

Audio Oscillator TS-382F/U
Frequency Meter AN/USM-26

	VOLUME: fully counter-clockwise			
2	Same as step No. 1 except: *AN/URM-48:* RF ATTENTUATOR MICROVOLTS: 10K	Same as step No. 1.	*a.* Connect TS-328F/U OUTPUT connector as in C, figure 43. *b.* Press M-80/GR push-to-talk switch and adjust TS-382F/U OUTPUT CONTROL for same voltage indication on TS-723B/U meter as recorded in step No. 1e. Release M-80/GR push-to-talk switch.	*a.* None. *b.* None.
3	Same as step No. 2 except: *TS-723B/U:* Function switch: SET LEVEL Meter range switch: 100 percent	Same as step No. 2.	*a.* Connect AF INPUT terminals of TS-723B/U as in B, figure 43. *b.* Press M-80/GR push-to-talk switch. Adjust the TS-723B/U INPUT control for an indication of 100 percent on the TS-723B/U meter. *c.* Turn TS-723B/U function switch to DISTORTION. Adjust the FREQUENCY and BALANCE control for minimum TS-723B/U meter indication. *d.* Turn TS-723B/U meter range switch to lower range and repeat adjustments of *c* above until null is obtained. Note indication on meter. *e.* Release M-80/GR push-to-talk switch.	*a.* None. *b.* None. *c.* None. *d.* Total distortion as indicated on the TS-723B/U meter must be 7 percent maximum. *e.* None.
4	N/A		Repeat the tests in steps 1, 2, and 3 above with TS-382F/U output frequencies of 5,000 and 10,000 cps.	Same as *d* of step 3 above.

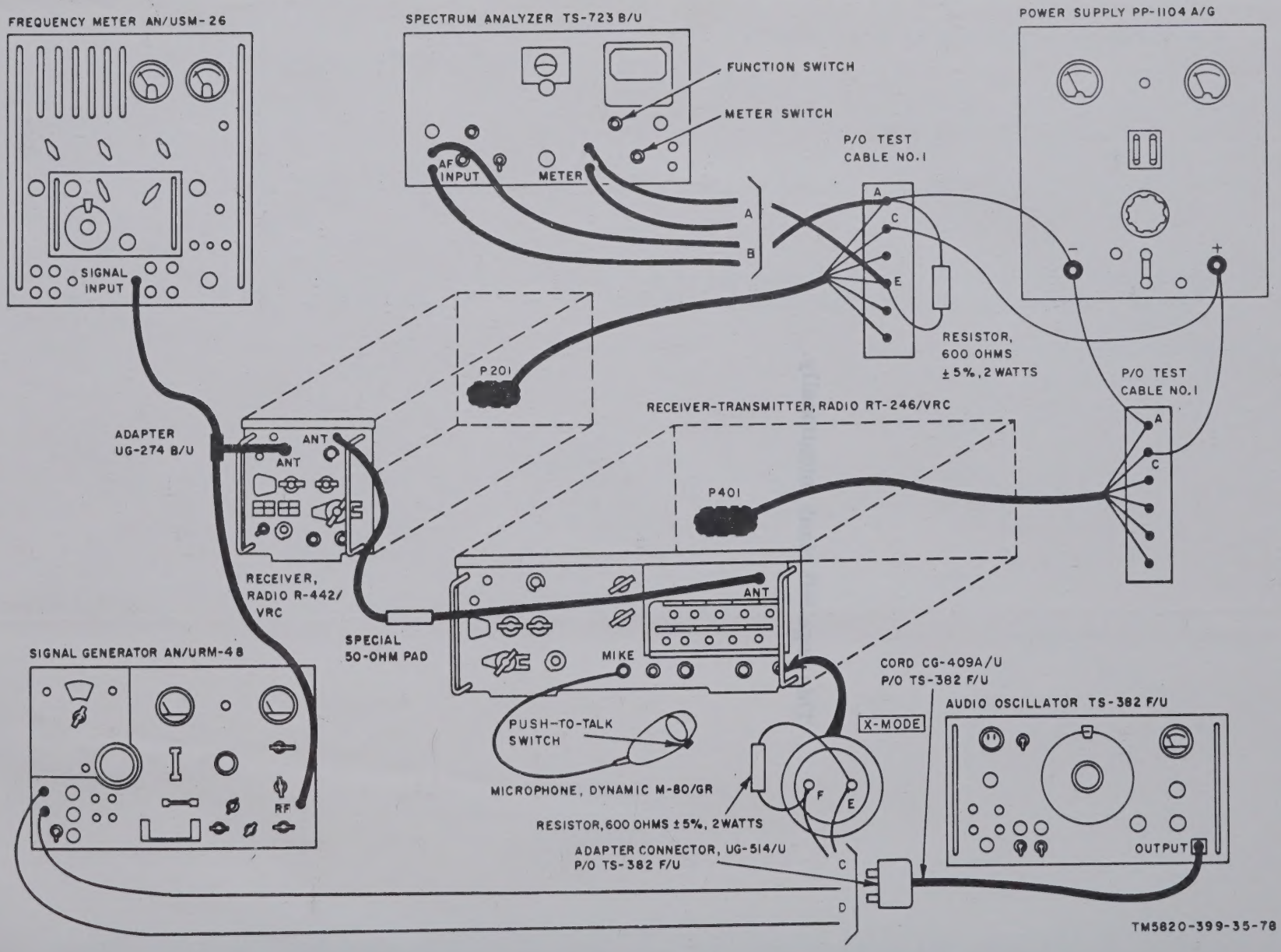


Figure 43. Receiver-transmitter wide-band total distortion test.

65. Transmitter Wide-Band Total Distortion Test

Perform this test in a screen room such as Electromagnetic Shielding Inclosure MX-1761/G or equivalent.

a. Test Equipment and Materials.

Audio Oscillator TS-382F/U
Frequency Meter AN/USM-26
Microphone, Dynamic M-80/GR
Power Supply PP-1104A/G
Receiver, Radio R-442/VRC
Signal Generator AN/URM-48
Spectrum Analyzer TS-723B/U
Adapter UG-274B/U
Resistor, 600 ohms ±5 percent, 2 watts (2 required)
Special 50-ohm pad (fig. 53)
Test Cable No. 1 (2 required)

b. Test Conditions and Connections. Connect equipment as shown in figure 43. The letters A through D, figure 43 refer to connection directions in the "Test procedures" column (*c* below). Make sure that filters FL4001 and FL4002 are in WIDE BAND OPERATION position, that X-MODE-NORMAL switch is in X-MODE, and that connector P303(P353) has been removed. Turn on the equipment and allow it to warm up for 5 minutes.

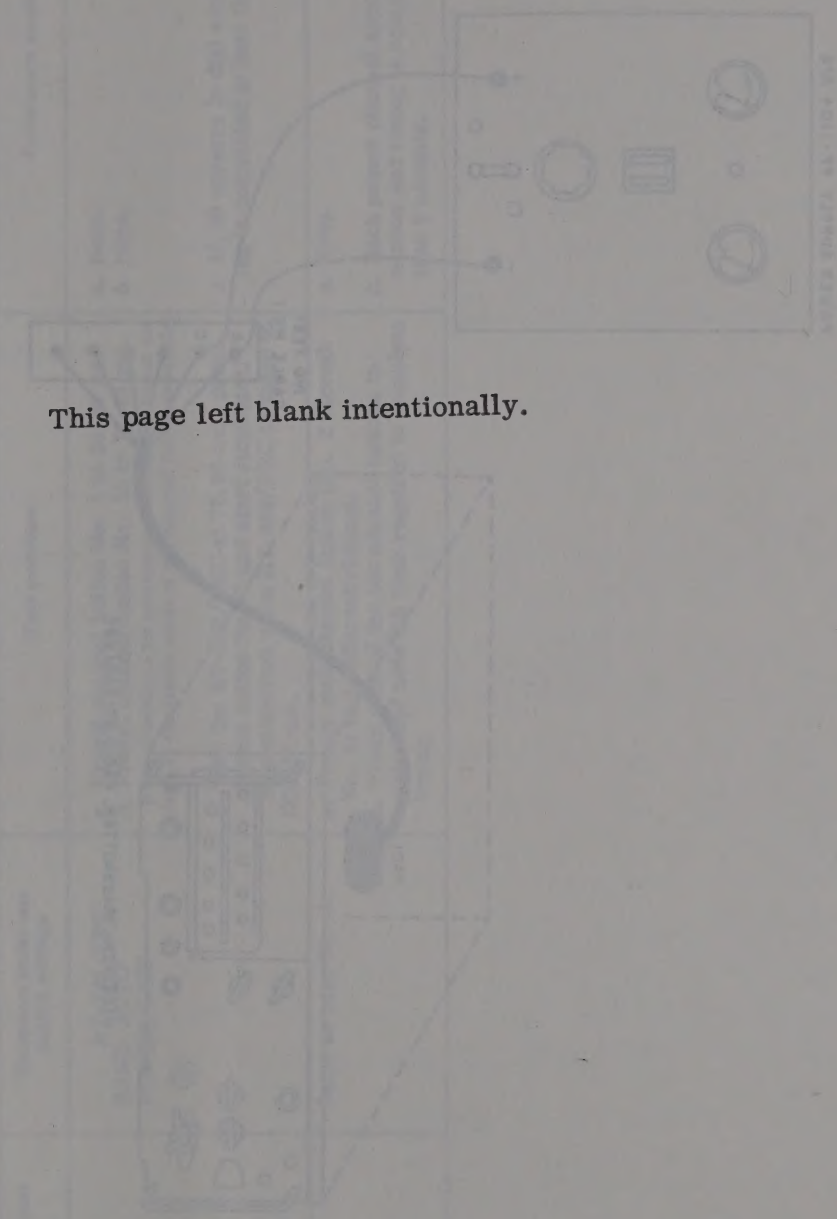
c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standard
1	*AN/USM-26:* TIME UNIT: EXT FUNCTION SELECTOR: FREQUENCY FREQUENCY UNIT: 1 RANGE MC: 20-40 MIXING FREQUENCY MCS: 30 TUNING: 30 GAIN: MAX *AN/URM-48:* BAND SWITCH: B RF TUNING: 30 MEGACYCLES DEVIATION RANGE: 25 OPERATION : EXT MOD DEVIATION LEVEL: for 20 kc on KILOCYCLES DEVIATION meter. RF SET TO LINE: right-hand meter to redline. RF ATTENUATOR MICROVOLTS: 10K *TS-723B/U:* RANGE: X10 INPUT: MIN FREQUENCY: dial indication of 100 Function switch: METER Meter range switch: R. M. S. VOLTS *TS-382F/U:* FREQUENCY MULTIPLIER: X10 Frequency dial: 100 OUTPUT MULTIPLIER: X1 OUTPUT CONTROL: fully counterclockwise *R-442/VRC:* LIGHT: ON BAND: A MC-TUNE-KC: 30.00 mc POWER: ON-RESET SQUELCH: OLD ON VOLUME: fully counterclockwise	*RT-246/VRC or RT-524/VRC:* LIGHT: ON BAND: A MC-TUNE-KC: 30.00 mc POWER: LOW SQUELCH: OLD ON VOLUME: counterclockwise SPEAKER: OFF (RT-524/VRC only)	*a.* Connect TS-723B/U METER terminals as in A, figure 43. *b.* Adjust AN/USM-26 TUNING control to close eye. *c.* Adjust AN/URM-48 RF TUNING control for 30.00-mm AN/USM-26 indication. *d.* Turn AN/URM-48 RF ATTENUATOR MICROVOLTS control to indicate 11.6 uv. *e.* Record the TS-723B/U meter inciation.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None.
2	Same as step No. 1 except: *AN/URM-48:* RF ATTENTUATOR MICROVOLTS: 10K	Same as step No. 1.	*a.* Connect TS-328F/U OUTPUT connector as in C, figure 43. *b.* Press M-80/GR push-to-talk switch and adjust TS-382F/U OUTPUT CONTROL for same voltage indication on TS-723B/U meter as recorded in step No. 1e. Release M-80/GR push-to-talk switch.	*a.* None. *b.* None.
3	Same as step No. 2 except: *TS-723B/U:* Function switch: SET LEVEL Meter range switch: 100 percent	Same as step No. 2.	*a.* Connect AF INPUT terminals of TS-723B/U as in B, figure 43. *b.* Press M-80/GR push-to-talk switch. Adjust the TS-723B/U INPUT control for an indication of 100 percent on the TS-723B/U meter. *c.* Turn TS-723B/U function switch to DISTORTION. Adjust the FREQUENCY and BALANCE control for minimum TS-723B/U meter indication. *d.* Turn TS-723B/U meter range switch to lower range and repeat adjustments of *c* above until null is obtained. Note indication on meter. *e.* Release M-80/GR push-to-talk switch.	*a.* None. *b.* None. *c.* None. *d.* Total distortion as indicated on the TS-723B/U meter must be 7 percent maximum. *e.* None.
4	N/A		Repeat the tests in steps 1, 2, and 3 above with TS-382F/U output frequencies of 5,000 and 10,000 cps.	Same as *d* of step 3 above.

FREQUENCY METER AN/USM-26

SPECTRUM ANALYZER TS-723 B/U

POWER SUPPLY PP-1104 A/G



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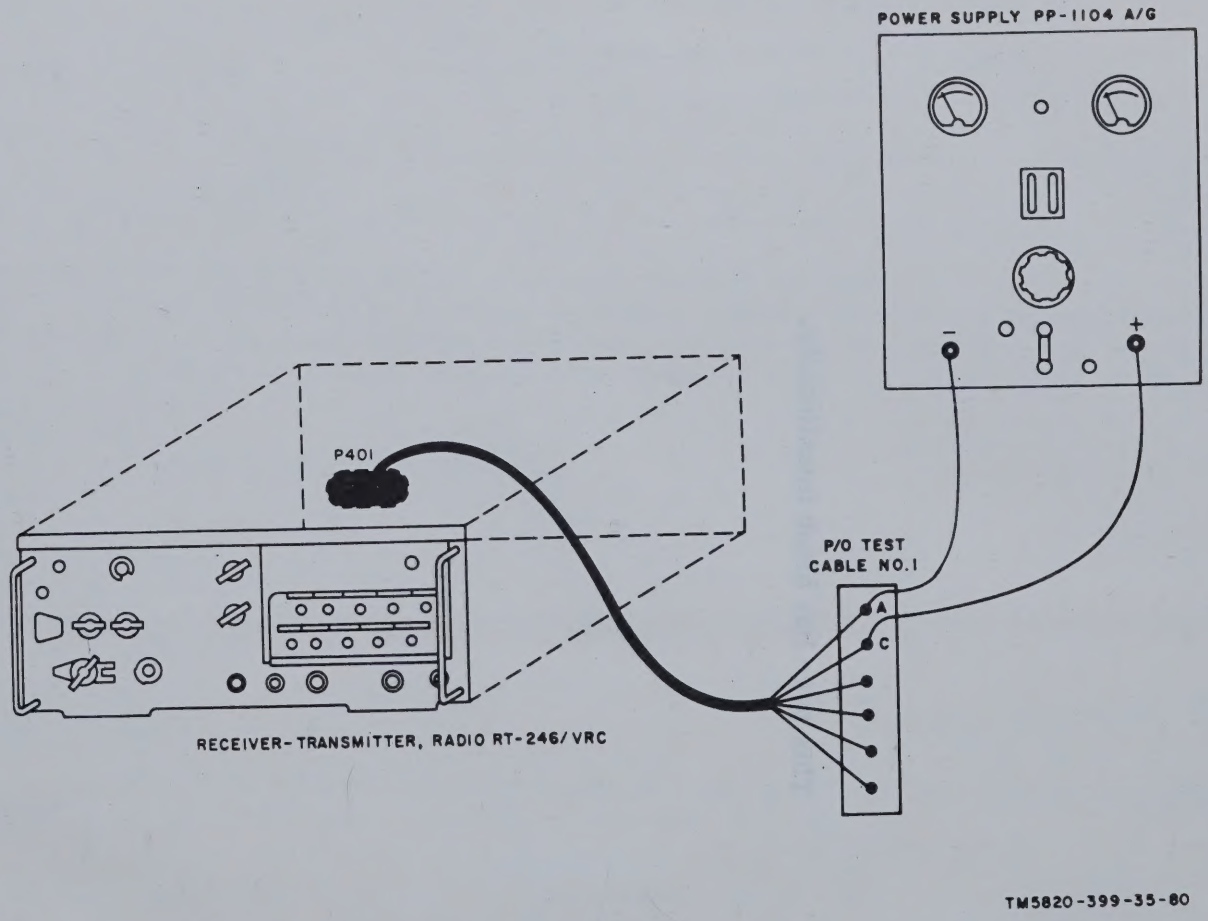


Figure 44. Automatic frequency selection test.

66. Automatic Frequency Selection Test (RT-246/VRC Only)

a. Test Equipment and Materials.
Power Supply PP-1104A/G
Test cable No. 1
Stopwatch

b. Test Connections and Conditions. Connect equipment as shown in figure 44. Turn on the equipment and allow it to warm up for 1 minute.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	N/A	*RT-246/VRC:* BAND: AUTO POWER: LOW	*a.* Preset channel button No. 1 to 30.00 mc. *b.* Preset channel button No. 10 to 75.95 mc. *Note:* Directions for presetting each channel button are given on the inside cover of the channel button assembly. *c.* With the RT-246/VRC at 75.95 mc, press channel button No. 1 and start stopwatch. Stop stopwatch when RT-246/VRC is tuned to 30.00 mc.	*a.* None. *b.* None. *c.* 30.00 appears in dial window and tuning is completed in less than 5 seconds.
2	N/A	Same as step No. 1.	*a.* Preset each channel button (No. 2 through No. 9) to a different channel. *b.* Press each of the ten channel buttons in order and note the time required to complete tuning.	*a.* None. *b.* Each preset channel appears in dial window and tuning is completed in less then 5 seconds.

67. Summary of Test Data

Personnel may find it convenient to arrange a checklist in a manner similar to that shown below:

TRANSMITTER PORTIONS OF RECEIVER-TRANSMITTERS, RADIO RT-246/VRC AND RT-524/VRC

	Test data		*Performance standard*	
	Low	*High*	*Low*	*High*
1. RF POWER OUTPUT				
a. 30.00 mc	———	———	1 to 4 watts	35 watts min
b. 42.00 mc	———	———	1 to 4 watts	35 watts min
c. 52.00 mc	———	———	1 to 4 watts	35 watts min
d. 53.00 mc	———	———	1 to 4 watts	35 watts min
e. 65.00 mc	———	———	1 to 4 watts	35 watts min
f. 75.00 mc	———	———	1 to 4 watts	35 watts min

2. FREQUENCY DEVIATIONS, SQUELCH DEVIATION, AND DEVIATION LIMITING	*Test data*	*Performance standard*
a. Frequency deviation at 60.05 mc	———	6 to 10 kc.
b. Squelch (NEW ON) operation	———	CALL indicator lights.
c. Squelch deviation at 60.05 mc	———	2.5 to 3.5 kc.
d. Frequency deviation with 1.1-volt modulating signal.	———	Less than 3-db increase in received audio output.

3. WIDE-BAND DEVIATION	*Test data*	*Performance standard*
a. With 0.773-volt modulation signal.	———	6 to 10 kc.
b. With 2.45-volt modulation signal	———	19 to 25 kc.

4. DISTORTION AND SIGNAL PLUS NOISE-TO-NOISE RATIO		
a. Maximum total distortion at 60.05 mc.	———	10%.
b. Minimum signal plus noise-to-noise ratio at 60.05 mc.	———	35 db.

5. WIDE-BAND TOTAL		
a. At 1,000 cps	———	7% max.
b. At 5,000 cps	———	7% max.
c. At 10,000 cps	———	7% max.

6. AUTOMATIC FREQUENCY SELECTION		
a. Accuracy	———	Assigned channel appears in window.
b. Tuning time between 30.00 at 75.95 mc.	———	5 seconds max.

CHAPTER 6

FIFTH ECHELON MAINTENANCE

Section I. GENERAL

68. Scope of Fifth Echelon Maintenance

The functions allocated to fifth echelon maintenance level include troubleshooting, repair, and alignment of modular assemblies and disassembly and assembly of the gear train assemblies.

69. Test Equipment and Additional Equipment Required

a. Test Equipment.

Item	Technical manual
Audio Oscillator TS-382F/U	TM 11-6625-261-12
Voltmeter, Electronic ME-30C/U	TM 11-6625-320-12
Frequency Meter AN/USM-26	TM 11-5057
Multimeter TS-352/U	TM 11-5527
Multimeter ME-26B/U	TM 11-6625-200-12
Oscilloscope AN/USM-50A	TM 11-5129
Power Supply PP-1104A/G	TM 11-5126
RF Signal Generator Set AN/URM-25.	TM 11-5551
Radio Frequency Wattmeter AN/URM-43A	TM 11-5133
Signal Generator AN/URM-48	TM 11-1257
Spectrum Analyzer TS-723B/U	TM 11-5097
Wide Band Amplifier 460AR (Hewlett-Packard)	
Cable Assembly, Radio Frequency CG-1773/U	
RF Vacuum Tube Voltmeter MV-18C (Millivac Instrument Corp.) (*b* below)	
Heterodyne Voltmeter Model 2002 (Bruel and Kjaer) (*b* below)	

b. Technical Characteristics of Special Test Equipments. Technical characteristics of those equipments (*a* above) that may not be presently available to fifth echelon maintenance personnel are listed below. These technical characteristics are a guide to the selection of equivalent test equipments necessary to conduct the required tests.

(1) *RF Vacuum Tube Voltmeter MV-18C.* The characteristics in parentheses below indicate the actual frequency range required to perform the fifth echelon maintenance procedures detailed in this manual.

Voltage range . . . . . 10 mv to 2.5 vdc, full-scale.
Frequency range . . . 1 mc to 200 mc, flat ±10 percent (5 to 15-mc).

(2) *Wide Band Amplifier 460AR.* Provides wide-band pulse amplification.

Voltage gain . . . . . 20 db.
Pulse risetime. . . . . 0.003 microsecond (not applicable).
Frequency range . . . 100 kc to 120 mc (5 to 15 mc).

c. Additional Equipment Required. All paragraph and figure references pertain to this manual unless otherwise stated.

Item	Fabrication information reference
Test cable No. 1	Figure 28
Test cables No. 6 through 8	Figure 44
Test assembly No. 1	TM 11-5820-409-35, figure 53
Assembly A6000 alignment test fixture	TM 11-5820-409-35, figure 56
Assembly A6000 alignment cover	Figure 46
Assembly A8100 alignment cover	Figure 47
Tool Kit TK-87/U	
Resistor, 470K, ±5 percent, 2 watts.	

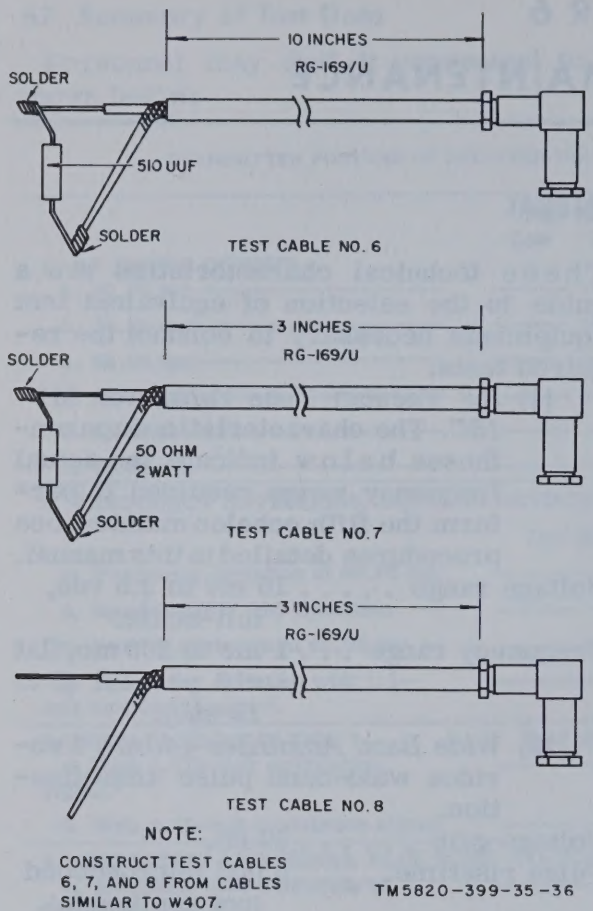


Figure 45. Test cables No. 6, U, and 8 fabrication.

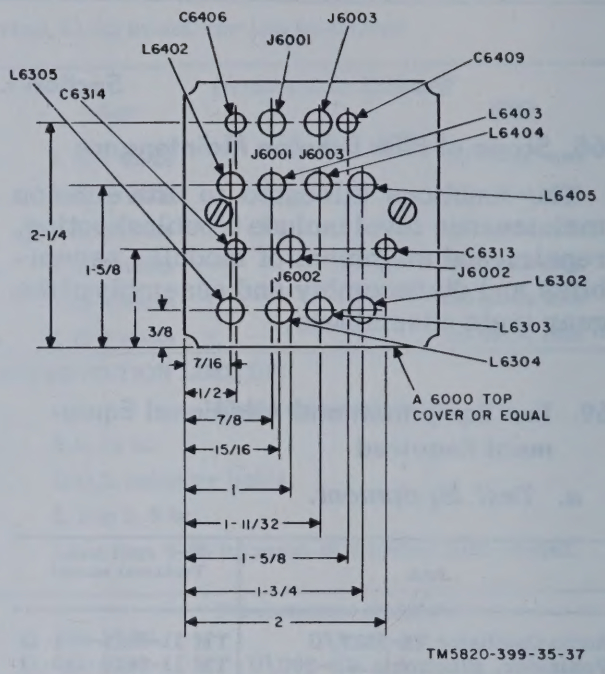


Figure 46. Assembly A6000 alignment cover, fabrication.

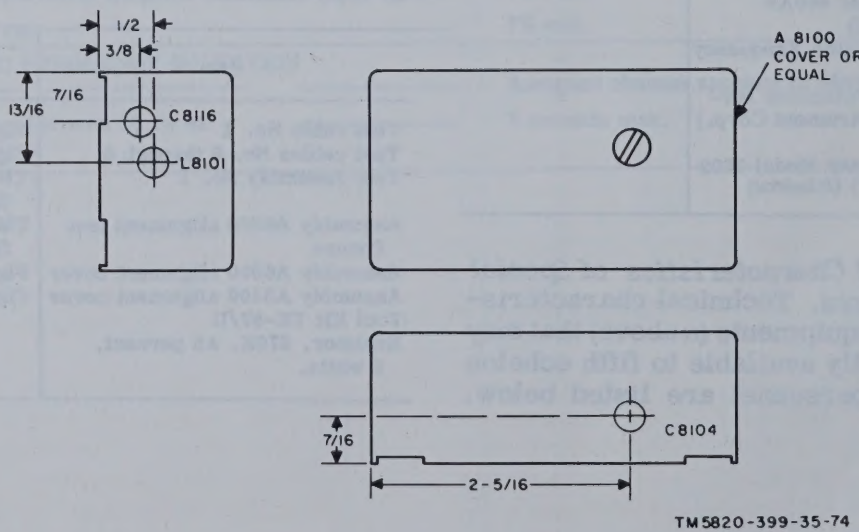


Figure 47. Assembly A8100 alignment cover, fabrication.

Section II. MODULE TROUBLESHOOTING, REPAIR, AND ALIGNMENT

70. Module Repair Procedures

a. These module repair procedures are organized to localize and isolate trouble in the modules that are part of the transmitter portion of the receiver-transmitter. The repair procedures for the receiver modules is covered in TM 11-5820-409-35. A separate procedure is provided for each module. Each procedure consists of preparation, test, isolation, and alignment (where applicable). The preparation steps detail the connection of test equipment and additional equipment (test cables, load, and isolating resistors and capacitors). They also specify the connectors or modules to be temporarily disconnected or removed to isolate the module under test. The tests are constructed to disclose the nature of the trouble, to check the effectiveness of parts replacement, and to check the response of the module to the alignment procedure. During faulty parts isolation, measurements are taken at points specified in the isolation data charts and compared to the listed normal performance levels. All voltage tests are made between chassis ground and the specified test point unless otherwise specified.

b. When the frequency of a signal generator is specified without an accompanying tolerance, set the frequency on the AN/USM-26 to the number of significant figures expressed. For example, 11.500 mc is set to an accuracy of five figures as indicated by the AN/USM-26.

c. A conventional notation is used to refer to the connectors on individual modules and the associated terminals on the main circuit boards. For example the notation "A8100-1" refers to the No. 1 connector on assembly A8100 and to its associated terminal on the A8000 main circuit board.

d. Assemblies A6000, A7000, A7200, and part of the A9000 have a special epoxy resin coating applied to their printed circuit boards. Use a test lead probe with a sharp tip to puncture epoxy coatings (where necessary) to make voltage or resistance measurements.

71. Preparation

a. Use a receiver-transmitter (as applicable) known to be good as a test set. Connect the required test equipment (para 69) to the connectors or test points specified to establish the proper connections for tests, alignment procedures, and faulty parts isolation. The module to be tested is provided with the proper terminations by other modules or by resistors installed during preparation. Temporary circuit modifications are specified when necessary to satisfy test requirements.

b. Test cables, alignment covers, and an alignment fixture are required to perform these procedures. Refer to paragraph 69*c* for fabrication information references.

c. Unless otherwise stated during the individual assembly test procedure, follow the general test in order.

Caution: **Before applying power to the receiver-transmitter, operate the switch of test cable No. 1 to the receive position.**

(1) Plug connector P303 into the X-MODE connector on the front panel when Receiver-Transmitter, Radio RT-246/VRC is used for alignment purposes. Plug connector P 353 into the X-MODE connector on the front panel when Receiver-Transmitter, Radio RT-524/VRC is used for alignment purposes.
(2) Apply +25.5 volts dc power to the receiver-transmitter from the PP-1104A/G through test cable No. 1.
(3) Connect the AN/URM-43A through Adapter UG-201/U and the CG-1773/U to the receiver-transmitter ANT connector.
(4) Turn the POWER switch to LOW.
(5) Turn the SQUELCH switch to OLD ON.
(6) After the test preparations preceding each test are completed, set the switch of test cable No. 1 to the transmit position.
(7) After each test is completed, set the switch of test cable No. 1 to the receive position.

(8) Whenever the MC-TUNE-KC controls are moved, first set the switch of test cable No. 1 to the receive position, adjust the MC-TUNE-KC controls, then return the switch of test cable No. 1 to the transmit position.
(9) Remove the top and bottom covers of the test receiver-transmitter.

72. Tests

a. The tests are performed following the general preparation. The tests compare performance of the module being tested with normal performance standards to disclose the nature of the trouble.

b. When the trouble is out-of-tolerance operation, alignment is specified first, to correct the trouble. This prevents needless parts replacement when the trouble can be corrected with an alignment touch-up.

c. When the trouble is a loss of circuit function, proceed directly to the isolation procedure, because this is usually caused by a component failure. Perform each test in the order listed, until the performance standards are met.

d. After the trouble isolation and repair have been completed, remove the repaired module and replace the original module in the test receiver-transmitter.

e. To set Heterodyne Voltmeter Model 2002 to a desired frequency, connect it to a signal generator, adjust the signal generator frequency for five significant figures on the AN/USM-26 and then tune the 2002 meter for a maximum indication. *Do not move the 2002 tuning control during the test.*

73. Alignment

Alignment is used first to correct troubles indicated by out-of-tolerance gain or poor frequency response and, where applicable, following replacement of faulty parts. Certain parts failures will evident only during alignment. For example, mechanical damage to an adjustable capacitor, coil, or transformer will become evident when alignment is attempted. Replace the part and repeat the particular alignment procedure.

a. When alignment is specified, first install the alignment covers (where required). After completion of the alignment procedure, replace the alignment cover with the original module cover. The chart (para 69) lists the test equipments, test cables, and test fixtures necessary for alignment. It also lists the appropriate technical manuals and fabrication information references.

b. Do not attempt very small angular adjustments on transformers. The slug is secured with a semirigid cement and may spring back and nullify the adjustment. Turn the adjustment at least 1/2 turn; return to the initial setting and proceed as required. When alignment is completed, use a fine camel's hair brush and brush Minnesota Mining and Manufacturing type EC-800 cement, or equivalent, on the threads to secure the slug. Apply the cement across the threads at three equally spaced positions.

74. Isolation

a. Isolation is the process to locate and replace faulty parts and is specified when a test discloses the loss of a circuit function. Isolation is also specified when out-of-tolerance operation is evident and alignment is not appropriate or if the circuit is not normal after alignment.

b. An externally generated test signal is applied to the module and signal voltage measurements are taken at selected circuit points. Typical signal voltages are listed for these circuit locations to provide information concerning the normal presence or absence of signal and the magnitude to be expected. A listing of typical dc voltages is included to supplement the information provided by the signal voltages. The typical dc voltage list order follows the dc distribution route in the module circuit. A listing of typical resistance measurements is also included for those modules that have no transistors, or where the transistors are power or switching types, and are not harmed by resistance measurements.

75. Precautionary Measures

Before placing the receiver-transmitter in the transmit condition:

a. Connect the AN/URM-43A to the receiver-transmitter ANT connector.

b. Allow the receiver-transmitter to warm up at least 1 minute (to allow tube warmup time).

c. Do not adjust the receiver-transmitter MC-TUNE-KC knobs during transmission. Operate the switch of test cable No. 1 to the receive position before turning the MC-TUNE-KC knobs.

Warning: **Extremely dangerous voltages of +275 and +700 volts dc exist in assemblies A9000, A6100, and A6200 during transmission. Take all necessary precautions to protect personnel and test equipment.**

76. Isolating Trouble Within Assembly A6000

The following test procedures check tracking error, isolation amplifier output level, buffer output level, frequency shift and bandwidth. Perform the test procedures with assembly A6000 installed in place of the identical assembly in a receiver-transmitter known to be operating properly. Refer to figure 65 for circuit details, and to figures 36, 48, and 49 for parts locations.

a. Test Equipment and Additional Equipment Required.

(1) Frequency Meter AN/USM-26.
(2) Heterodyne Voltmeter Model 2002 (Bruel and Kjaer).
(3) Multimeter TS-352/U.
(4) Multimeter ME-26B/U.
(5) Power Supply PP-1104A/G.
(6) RF Vacuum Tube Voltmeter MV-18C (Millivac Instrument Corp.).
(7) Assembly A6000 alignment cover (fig. 46).
(8) Assembly A6000 alignment test fixture (TM 11-5820-409-35, para 78).
(9) Test assembly No. 1 (TM 11-5820-409-35, fig. 53).
(10) Test cable No. 1 (fig. 28).
(11) Test cable No. 6 (fig. 45).
(12) Test cable No. 7 (2 required) (fig. 45).

b. Preparation.

(1) Perform the general test preparations (para 71*b*).
(2) Disconnect connectors P6001, P6002, and P6003 from connectors J6001, J6002, and J6003 of assembly A6000 (fig. 17). Connect test cable No. 6 to J6001 and test cable No. 7 to J6003. Short connector J6002 to ground.
(3) Connect the AN/USM-26 across the 50-ohm resistor of test cable No. 6.

c. Tracking Error, Isolation Amplifier Output, Buffer Output, Frequency Shift, and Bandwidth Tests. If any abnormal indications are obtained for the tests in (1) through (5) below, refer to figure 36 to isolate A6000 main circuit board defects, figure 48 for A6300 defects, and figure 49 for A6400 defects.

(1) *Tracking error test.*
(a) Turn the receiver-transmitter MC-TUNE-KC and BAND controls to 30.00 mc.
(b) Set the switch on test cable No. 1 to the transmit position.
(c) Read the AN/USM-26 frequency. The frequency should be between 29.865 and 31.135 mc.
(d) Set the switch of test cable No. 1 to the receive position.
(e) Repeat the procedures in (*a*) through (*d*) above for each of the following channels. The AN/USM-26 indication should be as stated in the "Frequency limits" column.

Channel (mc)	Frequency limits	
	Min (mc)	Max (mc)
37.00	36.865	37.135
45.00	44.865	45.135
52.00	51.865	52.135
53.00	52.865	53.135
60.00	59.865	60.135
69.00	68.865	69.135
75.00	74.865	75.135

(2) *Isolation amplifier output test.*
(a) Remove the AN/USM-26 and set switch of test cable No. 1 in the transmit position.

(b) Check the voltage at connector J6003; use the ME-26B/U. The reading should be between 0.22 to 0.40 volt ac.

(3) *Buffer output test.* Check the voltage at connector J6001; use the ME-26B/U. The reading should be 1.6 volts ac minimum.

(4) *Frequency shift test.*

(a) Remove the short at connector J6002 and connect test assembly No. 1 and the TS-352/U across the 50-ohm resistor of test cable No. 6. Plug the connector of test cable No. 6 into J6002.

(b) Connect the AN/USM-26 to connector J6003 through test cable No. 7.

(c) Adjust test assembly No. 1 to each voltage listed below and record the output frequency read on the AN/USM-26. A normal indication is a frequency deviation from 265 to 600 kc for each 1-volt change of the test assembly No. 1 voltage. Use the 0-volt dc frequency indication as a reference.

Test voltage (vdc)	Frequency change (kc)
0	Record for reference
-0.5	132.5 to 300
-1.0	265 to 600
-2.0	530 to 1,200
+0.5	132.5 to 300
+1.0	265 to 600
+2.0	530 to 1,200

(d) Set the switch of test cable No. 1 in the receive position, turn the MC-TUNE-KC and BAND controls to the 40.00-mc channel, and set the switch of test cable No. 1 in the transmit position.

(e) Adjust test assembly No. 1 to each voltage listed below and record the output frequency read on the AN/USM-26. A normal indication is a frequency deviation from 225 to 600 kc for each 1-volt change. Use the 0-volt dc frequency reading as a reference.

Test voltage (vdc)	Frequency change (kc)
0	Record for reference
-0.5	112.5 to 300
-1.0	225 to 600
-2.0	450 to 1,200
+0.5	112.5 to 300
+1.0	225 to 600
+2.0	450 to 1,200

(5) *Bandwidth test.*

(a) Adjust test assembly No. 1 to 0 volt dc output, connect the 2002 to connector J6001 and adjust it to read 0 db (para 70*d*).

(b) Adjust test assembly No. 1 for a +400.0-kc and then a -400.0-kc frequency deviation as indicated by the AN/USM-26. Record the output at connector J6001 in db for each deviation as indicated by the 2002. A normal indication for each 400.0-kc deviation is a reading of 1 db down, maximum.

(c) If near-normal indications are obtained, remove all test equipment and power from the receiver-transmitter, remove assembly A6000, and proceed to *d* below.

d. Alignment (fig. 46).

(1) Remove the assembly A6000 cover and replace it with the alignment cover.

(2) Turn the coupler shaft on assembly A6000 fully counterclockwise. Set the A6000 alignment test fixture dial to 0 divisions. Set the band switch lever on assembly A6000 straight up (band A).

(3) Mount assembly A6000 on the test fixture; make a slight adjustment in the assembly A6000 coupler so that it mates with the test fixture coupler.

(4) Connect one test cable No. 7 to connector J6001 and one to connector J6003. Short connector J6002 to ground.

(5) Connect the AN/USM-26 across the 50-ohm resistor of the test cable connected to connector J6003. Connect the PP-1104A/G to A6000-1 and A6000-2 (positive lead to

A-6000-2) and adjust the PP-1104A/G for +16 volts dc.

(6) Adjust shunt coil L6305 for an AN/USM-26 indication of 29.998 mc ±5 kc.

(7) Turn the alignment dial 400 divisions (2 revolutions) clockwise, and adjust trimmer capacitor C6314 for an AN/USM-26 indication of 40.845 mc ±5 kc.

(8) Turn the alignment dial 840 divisions (4.2 revolutions) clockwise from 0 divisions and adjust limit coil L6303 for an AN/USM-26 indication of 52.848 mc ±5 kc.

(9) Return the alignment dial to 0 divisions and repeat the steps in (6) through (8) above until all the frequencies listed in (6) through (8) above are obtained without further adjustment of the coils and capacitor listed in (6) through (8) above.

(10) Return the alignment dial to 0 divisions and connect the MV-18C to J6001.

(11) Adjust shunt coil L6405 for maximum indication on the MV-18C.

(12) Turn the alignment dial 400 divisions (2 revolutions) clockwise, and adjust trimmer capacitor C6409 for maximum output.

(13) Turn the alignment dial 840 divisions (4.2 revolutions) clockwise from 0 divisions and adjust limit coil L6403 for maximum output.

(14) Return the alignment dial to 0 divisions and repeat the steps in (11) through (13) above until no further increase in power output is obtained.

(15) Return the alignment dial to 0 divisions and turn the band switch lever 30° counterclockwise to the band B position.

(16) Adjust shunt coil L6302 for an AN/USM-26 indication of 53.110 mc ±5 kc.

(17) Turn the alignment dial 400 divisions (2 revolutions) clockwise and adjust trimmer capacitor C6313 for an AN/USM-26 indication of 63.829 mc ±5 kc.

(18) Turn the alignment dial 840 divisions (4.2 revolutions) clockwise from 0 divisions and adjust limit coil L6304 for an AN/USM-26 indication of 75.815 mc ±5 kc.

(19) Return the alignment dial to 0 divisions and repeat the steps in (16) through (18) above until the frequencies listed in (16) through (18) above are obtained without further adjustment.

(20) Return the alignment dial to 0 divisions and adjust shunt coil L6402 for a maximum indication on the MV-18C.

(21) Turn the alignment dial 400 divisions (2 revolutions) clockwise, and adjust trimmer capacitor C6406 for maximum output.

(22) Turn the alignment dial 840 divisions (4.2 revolutions) clockwise from 0 divisions and adjust limit coil L6404 for maximum output.

(23) Repeat the steps in (20) through (22) above until no further increase in power output is evident.

(24) Return the band switch lever to the band A position and the alignment dial to 0 divisions. Repeat the steps in (1) through (23) above until assembly A6000 reaches a stable state and shows no sign of frequency drift or changes in power output.

(25) Remove all power and test instruments. Remove assembly A6000 from the test fixture.

(26) Reinstall assembly A6000 and repeat the steps in *b* and *c* above.

77. Isolating Trouble Within Assembly A6100

The following test procedures check tracking error and output power, and provide typical voltage and resistance measurements. Perform test and alignment procedures with assembly A6100 installed in place of the identical assembly in a receiver-transmitter known to be operating properly. Use figures 22, 24, and 25 to locate test points and adjustments. Refer to figure 66 for circuit details.

a. Test Equipment Required. Only Multimeter, ME-26B/U is required.

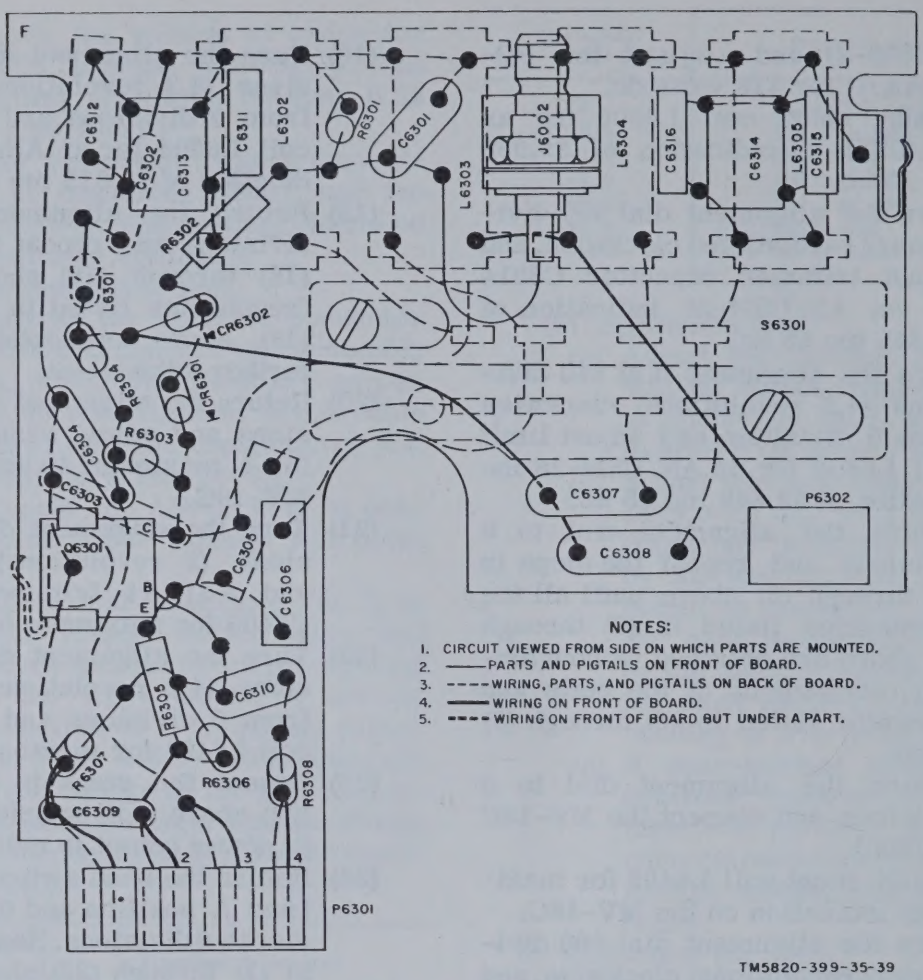


Figure 48. Assembly A6300, parts location and wiring diagram.

b. Preparation.

(1) Perform the general test preparation in paragraph 71.

(2) Disconnect connectors P6002 and P6003 from J6002 and J6003 on assembly A6000.

(3) Connect test assembly No. 1 through test cable No. 6 to J6002. Connect the TS-352/U to read the output of test assembly No. 1 (TM 11-5820-409-35) and adjust test assembly No. 1 for a reading of 0.0 volt dc.

(4) Connect the AN/USM-26 through cable No. 7 to J6003 on assembly A6000. Adjust the ME-26B/U for negative dc voltage measurement, and connect it between TP9006, on assembly A9000, and chassis ground.

c. Tracking Error and Output Power Test.

(1) Turn the receiver-transmitter MC-TUNE-KC and BAND controls to 30.00 mc.

(2) Set the switch in test cable No. 1 in the transmit position.

(3) Adjust test assembly No. 1 for a maximum negative dc voltage indication on the ME-26B/U. A normal indication is -1.0 volt dc minimum. Record the voltage at the 30.00 mc setting.

(4) Record the frequency. The frequency should be between 29.850 and 30.150 mc.

(5) Set the switch of test cable No. 1 in the receive position.

(6) Repeat the procedures in (1) through (5) above for each of the

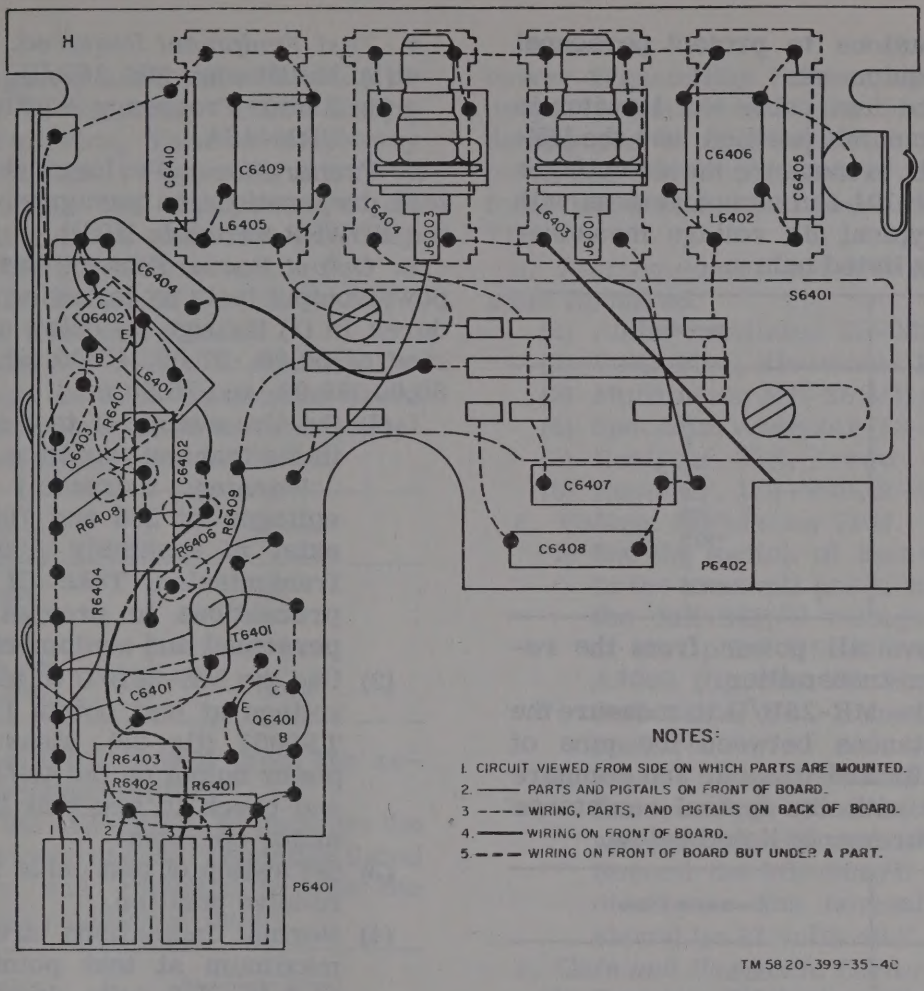


Figure 49. Assembly A6400, parts location and wiring diagram.

following channels. The ME-26B/U indication should be as stated in the "Frequency limits" column. If these requirements are met the A6100 is operable.

Channel (mc)	Frequency limits	
	Min (mc)	Max (mc)
37.00	36.850	37.150
45.00	44.850	45.150
52.00	51.850	52.150
53.00	52.850	53.150
60.00	59.850	60.150
69.00	68.850	69.150
75.00	74.850	75.150

(7) If abnormal or near normal indications are obtained, proceed to *d* below. If abnormal indications are obtained, proceed to *e* below.

d. Alignment.

(1) Align the A6100 (para 41).

(2) If the A6100 does not align, proceed to step *e* below. If the A6100 does align, repeat *b* and *c* above.

e. Isolation.

(1) Perform the general test preparations in paragraph 71. Disconnect the ME-26B/U.

(2) Connect assembly A6100 for normal operation.

(3) Disconnect connector P6001 from J6001 on assembly A6000. Remove electron tube V6101 from assembly A6100.

Warning: **A dangerous voltage of 275 volts dc exist at pins 6, 7, and 9 of tube socket XV6101 during transmission. Take all necessary**

precautions to protect personnel and equipment.

(4) Set the test cable No. 1 switch in the transmit position; use the ME-26B/U to measure the dc voltages at XV6101 and compare them with the typical dc voltage measurements listed below.

Pin	Dc volts
1	0
2	0
3	0
4	+6.3
5	0
6	+275
7	+275
8	0
9	+275

(5) Remove all power from the receiver-transmitter.

(6) Use the ME-26B/U to measure the resistances between the pins of XV6101 and ground, and compare them with the typical resistance measurements listed below.

Pin	Resistance (ohms)
1	220
2	4,700
3	220
4	Greater than 0
5	0
6	Infinity
7	Infinity
8	220
9	Infinity

(7) Replace all faulty parts and repeat the steps in *b* through *d* above.

78. Isolating Trouble Within Assembly A6200

The following test procedures check output power over the full frequency range of the receiver-transmitter, and provide typical voltage and resistance measurements. Perform the test procedures with assembly A6200 installed in place of the identical assembly in a receiver-transmitter known to operating properly. Refer to figure 66 for circuit details and to figures 23 through 25 to locate parts.

a. Test Equipment Required.

(1) Multimeter ME-26B/U.

(2) Radio Frequency Wattmeter AN/URM-43A.

b. Preparation. Perform the general test preparations in paragraph 71. Turn the POWER switch to HIGH.

c. Output Power Test. Perform the power output tests by following the procedures in (1) through (3) below at frequencies of 30.00, 37.00, 45.00, 52.00, 53.00, 60.00, 69.00, and 75.00 mcs.

(1) Set the switch of test cable No. 1 in the transmit position.

Warning: **Extremely dangerous voltages of 280 and 700 volts dc exist in assembly A9000 during transmission. Take all necessary precautions to prevent injury to personnel and equipment.**

(2) Use the ME-26B/U to measure the voltage at test points TP9006 and TP9007 (fig. 29). Measure the rf power output on the AN/URM-43A, and check to see that the blower motor operates.

(3) Set switch of test cable No. 1 in the receive position.

(4) Normal indications are -1.8 vdc maximum at test point TP9007, -1.0 to -1.5 volts dc at test point TP9006, 35 watts minimum on the AN/URM-43A, and the blower motor operates.

(5) If abnormal indications are obtained, proceed to *d* below.

(6) If near normal indications are obtained, align the A6200 (para 42) and repeat *b* and *c* above.

d. Alignment. Align the A6200 (para 42). If the A6200 does not align proceed to *e* below. If the A6200 does align, repeat *b* and *c* above.

e. Isolation.

(1) Remove the cover plate from assembly A6200.

(2) Remove electron tubes V6201 and V6101 from assemblies A6200 and A6100 respectively (TM 11-5820-401-20).

(3) Perform the general test preparations in paragraph 71.

Warning: **Extremely dangerous**

voltages of +280 and +700 volts dc exist in assembly A6200 during transmission. Take all necessary precautions to prevent injury to personnel and equipment when working in or near this assembly with the cover removed.

(4) Set the switch of test cable No. 1 in the transmit position.

(5) Use the ME-26B/U to measure the voltage at each connection listed and compare them with the typical dc voltage indications listed.

Socket connection	Dc volts
Plate yoke	+700
Screen ring	+275
Grid ring	-14
Cathode ring	0
Heater ring	+25.5

(6) Remove all power from the receiver-transmitter.

(7) Use the ME-26B/U to measure the resistance at each connection listed below and compare it with the typical resistance listed.

Socket connection	Resistance (ohms)
Plate yoke	450K
Screen ring	Infinity
Grid ring	910
Cathode ring	0
Heater ring	Greater than 0 but less than 50

(8) Replace all faulty parts, electron tubes V6101 and V6102, and the cover on assembly A6200. Repeat the steps in *b* through *d* above.

79. Isolating Trouble Within Assembly A8500

(fig. 26, 50, and 64)

Use the following test procedures to check voltage regulation, gain, and harmonic distortion. Perform the alignment, signal tracing and dc voltage measurements. Perform the test and alignment procedures with assembly A8500 installed (swung out and with its braces secured) in place of the identical assembly in a receiver-transmitter known to be operating properly. Refer to figure 64 for circuit details and to figures 26 and 50 to locate parts and test points. Before testing, perform the general test preparations (para 71).

a. Test Equipment and Additional Equipment Required.

(1) Audio Oscillator TS-382F/U.
(2) Voltmeter, Electronic ME-30C/U.
(3) Multimeter ME-26B/U.
(4) Spectrum Analyzer TS-723B/U.
(5) Resistor, 33K, 2-watt.
(6) Resistor, 150-ohm, 2-watt.

b. Voltage Regulation Test.

(1) Set the switch of test cable No. 1 in the transmit position and record the ME-26B/U voltage indication at test point TP8006 on assembly A8000 (fig. 26). Set the switch of test cable No. 1 in the receive position.

(2) Repeat the instructions in (1) above for receiver-transmitter input voltages of +22 and +30 volts dc. Record the ME-26B/U voltage indications. The normal indication should be 12 volts ±0.7.

c. Gain and Harmonic Distortion Test.

(1) Remove the cover from assembly A8500.

(2) Connect the hot lead of the TS-382F/U through the 33K resistor to terminal 2 (fig. 50) of the A8500, and the TS-382F/U ground lead to the receiver-transmitter chassis.

(3) Connect the 150-ohm resistor between terminal 2 of the A8500 and the receiver-transmitter chassis. Connect the ME-30C/U across the 150-ohm resistor.

(4) Adjust the TS-382F/U to 1,000 cps and an ME-30C/U indication of 1.5 millivolts (mv).

(5) Connect the TS-723B/U as a voltmeter between test point TP8004 of assembly A8000 and the receiver-transmitter.

(6) Set the switch of test cable No. 1 in the transmit position and note the TS-723B/U indication. The normal indication should be 36 mv ±2.0.

(7) Use the TS-723B/U to measure the voltage at terminal 8 of assembly A8500 (fig. 50). The normal indication should be 0.77 volt ac ±0.2.

(8) Connect and adjust the TS-723B/U for voltage-decibel and harmonic distortion measurements at TP8004 of assembly A8000.

(9) Adjust the TS-382F/U to each of the following frequencies maintaining an ME-30C/U indication of 1.5 mv: 1,000, 500, 2,000, 2,500, and 3,000 cps. Measure the A8500 output level and harmonic distortion with the TS-723B/U at each frequency; use the 1,000-cps indication as the 0-decibel (db) reference. The output level variations should be less than ±2 db from the 1,000-cps reference level and less than three percent distortion.

(10) Reset the TS-382F/U to 1,000 cps and an ME-30C/U indication of 1.5 mv. Adjust the TS-723B/U for 0 db voltage reference.

(11) Increase the TS-382F/U output for and ME-30C/U indication of 7.5 mv and note the TS-723B/U indication. The output level variation should be less than +3 db from the 1,000 cps -1.5 mv reference and 5 percent harmonic distortion or less. If the requirements in (6), (7), (9), and (11) above were met, the A8500 is operable.

(12) If abnormal indications are obtained in (6), (7), (9), and (11) above, proceed to *e* below.

(13) If near normal indications are obtained, proceed to *d* below.

d. Alignment.

(1) Perform the test preparations in paragraph 71 and in *c*(1) through (5) above.

(2) Set the switch of test cable No. 1 in the transmit position and adjust potentiometer R8516 (fig. 50) for a TS-723B/U indication of 36 mv ±2.0 at test point TP8004.

(3) Set the switch of test cable No. 1 in the receive position and reconnect the TS-382F/U, 33K isolation resistor, 150-ohm load resistor, and ME-30C/U to terminal 4 of assembly A8500 (fig. 50).

(4) Adjust the TS-382F/U for an output of 150 cps and a ME-30C/U indication of 0.5 volt ac. Turn the SQUELCH switch to OLD ON.

(5) Set the switch of test cable No. 1 in the transmit position and adjust potentiometer R8515 (fig. 50) for a TS-723B/U indication of 15.0 mv ±1.0.

(6) Set the switch of test cable No. 1 to the receive position.

(7) If the assembly did not align, proceed to *e* below.

(8) If the assembly aligned, repeat *b* and *c* above.

e. Isolation.

(1) Repeat the steps in *c*(2) and (3) above.

(2) Reduce the TS-382F/U input voltage at terminal 2 of assembly A8500 to 1.4 mv (ME-30C/U indication) at 1,000 cps.

(3) Remove the TS-723B/U from test point TP8004, measure the signal voltage between each junction listed below and chassis ground and compare it with the typical voltage listed in the chart below.

Junction (fig. 50)	Rms volts
A8500-5[a]	0.0013
Q8501 base	0.0013
Q8501 emitter	0.0017
Q8501 collector	0.05
Q8503 emitter	0.0025
Q8504 base	0.8
Q8504 emitter	0.072
Q8504 collector	1.9
C8504 and CR8501	0.0011
L8501 and CR8504	0.012
CR8502 and CR8503	1.8
CR8503 and R8509	0.44
A8500-7[a]	0.74
A8500-3[a]	6.0
C8509 and R8514	0.45
R8518 and R8515	0.25
A8500-10[a]	0.04
R8513 and R8516	0.1
A8500-8[a]	0.74

[a] These items refer to the numbered terminals of assembly A8500 (fig. 50).

(4) Measure the dc voltage between each junction listed below and

chassis ground, with the ME-26B/U, and compare it with the typical voltage listed.

Junction (fig. 44)	Dc volts
A8500-9[a]	16.0
Q8501 base	3.4
Q8501 collector	6.7
Q8501 emitter	2.8
Q8503 emitter	7.2
Q8504 base	3.9
Q8504 emitter	3.2
Q8504 collector	12.0
R8521 and R8522	0.4
CR8504 and L8501	2.1
CR8501 and C8504	0.6
Q8502 emitter	0.87
Q8502 collector	7.2
Q8502 base	1.45
CR8503 and CR8502	3.2
R8509 and CR8503	4.1
A8500-6[a]	11.5

[a] These items refer to the numbered terminals of assembly A8500 (fig. 50).

(5) Replace all faulty parts and repeat the procedures in *b* through *d* above.

80. Isolating Trouble Within Assembly A8100

Use the following test procedures to check output frequency, output level, deviation, and harmonic distortion. Perform the alignment, signal tracing, and voltage measurement procedures. These procedures are performed with the A8100 installed in place of the identical assembly in a receiver-transmitter known to be operating properly. Refer to figure 64 for circuit details and to figures 26 and 51 to locate parts and test points.

a. Test Equipment and Additional Equipment Required.

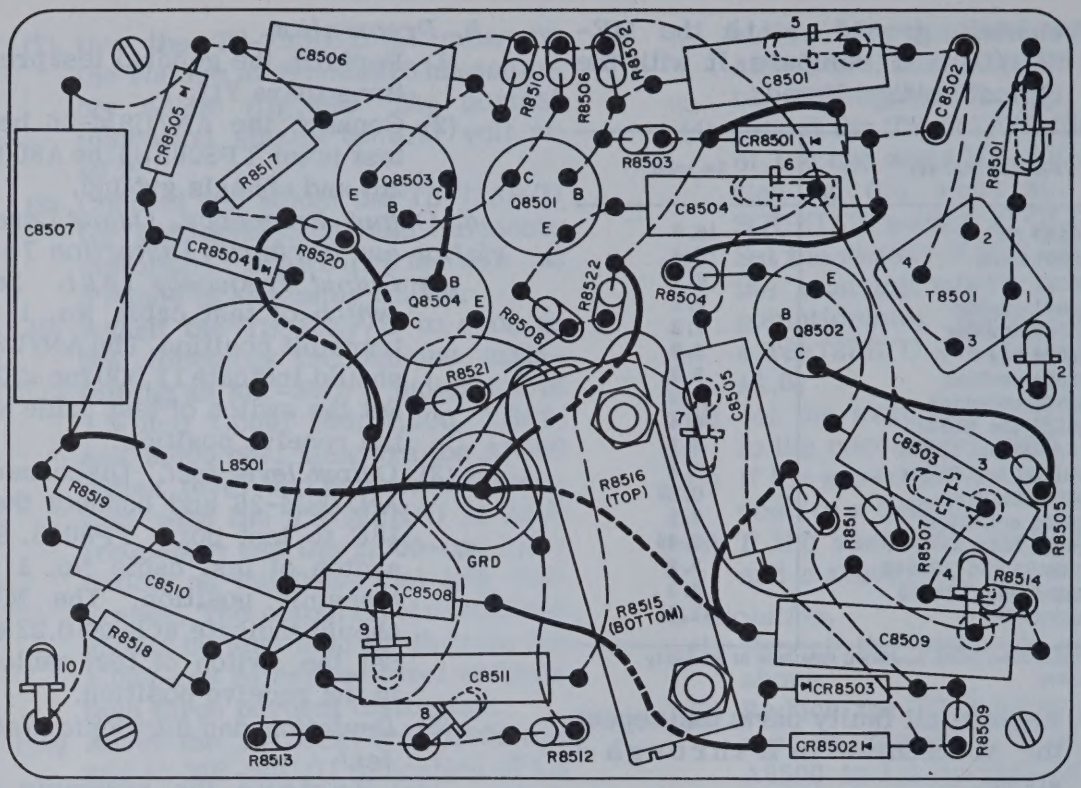
(1) Audio Oscillator TS-382F/U.
(2) Voltmeter, Electronic ME-30C/U.
(3) Frequency Meter AN/USM-26.
(4) Receiver, Radio R-442/VRC.
(5) RF Vacuum Tube Voltmeter MV-18C (Millivac Instrument Corps).
(6) Signal Generator AN/URM-48.
(7) Spectrum Analyzer TS-723B/U.
(8) Resistor, 150 ohms, 2 watts, ±5 percent.
(9) Resistor, 33K, 2 watts, ±5 percent.

b. Preparation.

(1) Perform the general test preparations (para 71).
(2) Connect the AN/USM-26 between test point TP8005 on the A8000 (fig. 26) and chassis ground.

c. Output Frequency, Output Level, Deviation and Harmonic Distortion Tests.

(1) *Output frequency test.* Set the switch of test cable No. 1 in the transmit position. The AN/USM-26 should indicate 11.500 mc ±200 cps. Set the switch of test cable No. 1 in the receive position.
(2) *Output level test.* Disconnect the AN/USM-26 and connect the MV-18C to test point TP8005. Set the switch of test cable No. 1 in the transmit position. The MV-18C should indicate at least 0.22 volt rf. Set the switch of test cable No. 1 in the receive position.
(3) *Deviation and harmonic distortion test.*
(a) Remove the assembly A8500 cover. Connect the TS-382F/U through the 33K resistor to terminal 2 of the A8500 (fig. 50). Connect the 150-ohm resistor between terminal 2 of the A8500 and chassis ground.
(b) Connect the ME-30C/U to test point TP8004 on assembly A8000 and adjust the TS-382F/U to 1,000 cps with an output of 36 mv at test point TP8004.
(c) Set up a Receiver, Radio R-442/VRC, known to be in good operating condition, to receive on the receiver-transmitter frequency. Turn the receiver SQUELCH control to OLD ON. Connect the TS-723B/U to measure the receiver audio output level and harmonic distortion.
(d) Loosely couple the receiver to the transmitter. Use adequate coupling to assure receiver limiting. Set the switch of test cable No. 1 in the transmit position.
(e) Adjust the receiver VOLUME control to any convenient setting. Without moving the receiver



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ------ PARTS ON FRONT OF BOARD BUT UNDER A PART.
4. — — — WIRING ON BACK OF BOARD.
5. ▬▬▬ WIRING ON FRONT OF BOARD.
6. ▬ ▬ ▬ WIRING ON FRONT OF BOARD BUT UNDER A PART.

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Figure 50. Assembly A8500, parts location and wiring diagram.

VOLUME control, perform the steps in (*f*) through (*i*) below.

(*f*) Adjust the TS-382F/U to the frequencies listed below while maintaining 36 mv at test point TP8004 and record the audio voltage and harmonic distortion at each frequency.

Frequency (cps)
1,000
500
1,500
2,000
2,500
3,000
5,000
10,000
20,000

(*g*) Set the switch of test cable No. 1 in the receive position and uncouple the receiver from the receiver-transmitter.

(*h*) Connect the AN/URM-48 cable to the receiver ANT connector. Adjust the AN/URM-48 to the frequency of the receiver channel at a level sufficient to cause the receiver limiter to function (approximately 0.5 microvolt).

(*i*) Reconnect the TS-382F/U to the EXT MOD and GND terminals on the AN/URM-48, adjust the TS-382F/U to each frequency in (*f*) above at full output, and adjust the AN/URM-48 deviation output (approximately 8 kc) to cause the TS-723B/U to indicate the same audio voltage recorded at each

frequency in (*f*) above. Record the deviation shown on the AN/URM-48 and the receiver harmonic distortion for each frequency.

(j) The deviations obtained as instructed in *i* above are equal to the deviations of assembly A8100. A normal indication is a deviation of 8 kc ±1.5 at 1,000 cps. Use the deviation obtained at 1,000 cps as the reference deviation.

1. For deviations of 500, 1,500, 2,000, 2,500, and 3,000 cps, a normal indication is +0 to -0.5 kc of the 1,000-cps reference deviation.
2. For deviations of 5,000, 10,000, and 20,000 cps, a normal indication is +0 to -1.5 kc of the 1,000-cps reference deviation.

(k) Subtract the harmonic distortion at each frequency in (*i*) above from those for the same frequency in step (*f*) above to obtain the true assembly A8100 harmonic distortion. A normal indication is 2 percent harmonic distortion or less. If the requirements of *c*(1), *c*(2), *c*(3)(*j*), and *c*(3)(*k*) were met the A8100 is operable.

(l) If abnormal indications are obtained, proceed to e below.

(m) If near normal indications are obtained, proceed to *d* below.

d. Alignment.

(1) Remove the cover from assembly A8100. Place a short across capacitor C8112 (fig. 51). Install the A8100 alignment cover (fig. 47).

(2) Remove assemblies A8400 and A8500. Connect test cable No. 2 between A8500-6 and A8500-9 and the corresponding pins on assembly A8000.

(3) Connect the AN/USM-26 to test point TP8005 on assembly A8000 (fig. 26). Set the test cable No. 1 switch in the transmit position.

(4) Adjust oscillator trimmer capacitor C8104 (fig. 51) for an AN/USM-26 indication of 11,500 kc ±2.0. Set the test cable No. 1 switch in the receive position.

(5) Remove the alignment cover and the short across capacitor C8112. Replace the alignment cover and set the test cable No. 1 switch in the transmit position.

(6) Adjust discriminator trimmer capacitor C8116 (fig. 51) for an AN/USM-26 indication of 11,500 mc ±200 cps. Set the test cable No. 1 switch in the receive position.

(7) If the assembly aligns, repeat *b* and *c* above.

(8) If the assembly does not align, proceed to *e* below.

e. Isolation.

(1) Remove the alignment cover and all test equipment. Set the switch of test cable No. 1 in the transmit position.

(2) Use the MV-18C to measure the rf voltage at each junction listed below and compare it with the typical rf voltage listed.

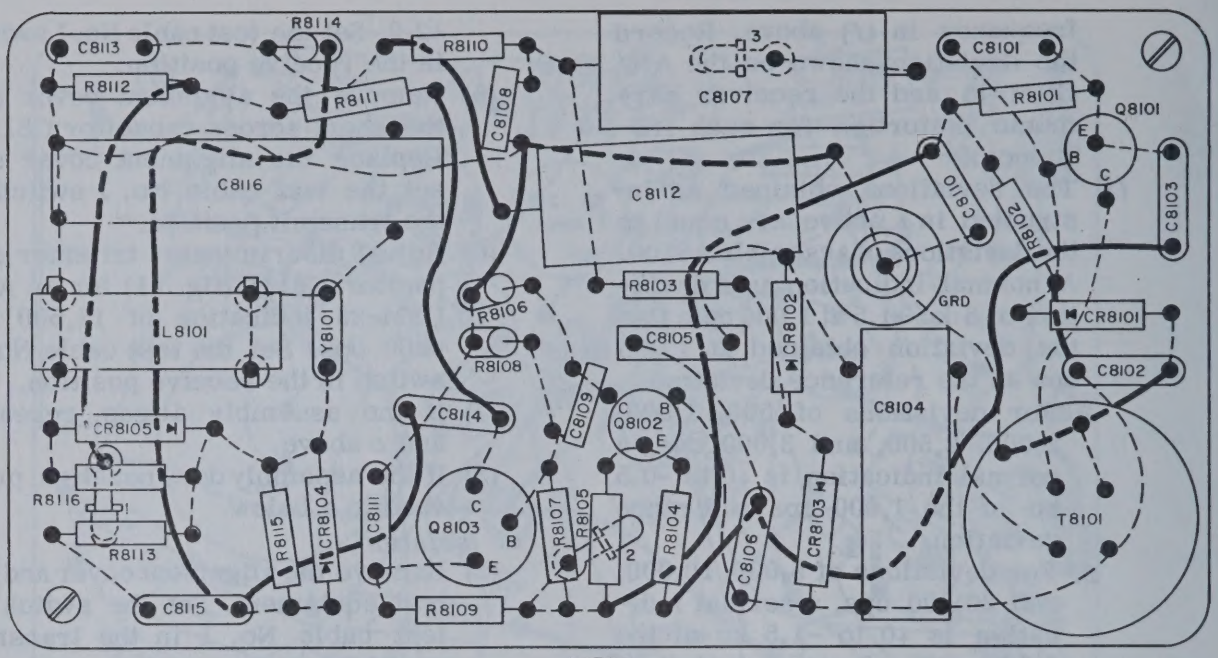
Junction (fig. 45)	Rf volts
A8100-1[a]	0.23
Q8103 collector	2.1
Q8103 emitter	12 mv
Q8103 base	0.42
Q8102 collector	0.42
Q8102 emitter	18 mv
C8105 and C8106	0.15
Q8101 Collector	0.8
C8114 and C8115	0.21
R8113 and C8115	0.2
CR8104 and CR8105	0.18

[a] This item refers to the numbered terminal of assembly A8100 (fig. 51).

(3) Use the ME-26B/U to measure the dc voltage at each junction below and compare to the typical dc voltage listed.

Junction (fig. 51)	Dc volts
A8100-2[a]	+11.5
Q8103 emitter	+9.5
Q8103 base	+9.5
Q8102 base	+5.5
Q8102 emitter	+5.8
R8101 and C810[illegible]	+5.6

[a] This item refers to the numbered terminal of assembly A8100 (fig. 51).



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. - - - - - - PARTS ON FRONT OF BOARD BUT UNDER A PART.
4. — — — WIRING ON BACK OF BOARD.
5. ——— WIRING ON FRONT OF BOARD.
6. — — — WIRING ON FRONT OF BOARD BUT UNDER A PART.

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Figure 51. Assembly A8100, parts location and wiring diagram.

(4) Replace all faulty parts, assembly A8100 cover, assemblies A8400 and A8500, and repeat the steps in *b* and *c* above.

81. Isolating Troubles Within Assembly A8300

Use the following test procedures to check gain, limiting level, and bandwidth. Perform the alignment, signal tracing, and voltage measurements to isolate faulty parts in assembly A8300. Perform these procedures with assembly A8300 installed in place of the identical assembly in a receiver-transmitter known to be operating properly. Refer to figure 64 for circuit details and to figures 26 and 52 to locate parts and test points.

a. Test Equipment and Additional Equipment Required.

(1) Frequency Meter AN/USM-26.
(2) Multimeter, ME-26B/U.
(3) RF Signal Generator Set AN/URM-25.
(4) Rf Vacuum Tube Voltmeter MV-18C (Millivac Instrument Corp.).
(5) Wide Band Amplifier 460AR (Hewlett-Packard).
(6) 50-ohm adapter (part of 460AR).
(7) Adapter UG-274B/U.
(8) Test cable No. 8.

b. Preparation.

(1) Make the general test preparations in paragraph 71.
(2) Remove connector P8301 from connector J8301 on assembly A8300 (fig. 52).
(3) Connect the output of the 460AR through test cable No. 8 to J8301; use the 50-ohm adapter (part of the 460AR). Connect the AN/URM-25 to the input of the 460AR; use Adapter UG-274B/U.
(4) Connect the MV-18C to the junction of cable No. 8 and the 460AR to measure the AN/URM-25 output voltage, and to test point TP8003 on assembly A8000 (fig. 26) when

measuring the assembly A8300 output voltage.

(5) Connect the AN/USM-26 to the AN/URM-25 output terminals.

c. Gain, Limiting Level, and Bandwidth Tests.

(1) *Gain test.*

(a) Set the switch of test cable No. 1 in the transmit position.

(b) Adjust the AN/URM-25 for an AN/USM-26 indication of 10.500 mc ±0.001. Adjust the AN/URM-25 output for an MV-18C indication of 10 MV. Measure and record the A8000 output voltage, with the MV-18C at test point TP8003. A normal indication is 190 mv root mean square (rms) minimum.

(3) *Limiting level test.* Adjust the AN/URM-25 output for an MV-18C indication of 0.5 volt rf. Use the MV-18C to measure the output voltage at test point TP8003. A normal indication is 0.33 volt rms ±0.05.

(a) Bandwidth test. Adjust the AN/URM-25 for an AN/USM-26 indication of 12.250 mc. Adjust the AN/URM-25 output for a MV-18C indication of 10 MV. Measure and record the voltage at test point TP8003; use the MV-18C. A normal indication is within ±3 db of the indication recorded in (2) above.

(b) Adjust the AN/URM-25 for an AN/USM-26 indication of 10.750 mc. Adjust the AN/URM-25 output for a MV-18C indication of 10 MV. Use the MV-18C to measure the output at test point TP8003. A normal indication is within ±3 db of the indication recorded in (2) above, and within ±1 db of the indication recorded in (4) above.

(c) If abnormal indications are obtained, proceed to *e* below.

(d) If near normal indications are obtained, proceed to *d* below.

d. Alignment.

(1) Make the test preparations given in *b* above and remove the cover from assembly A8300.

(2) Adjust the AN/URM-25 for an AN/USM-26 indication of 10.500 mc ±0.001. Adjust the AN/URM-25 output for an MV-18C indication of 10 MV.

(3) Connect the MV-18C to TP8003 of assembly A8000 and adjust transformers T8303, T8302, and T8301 (fig. 52), in order, for maximum output. If the output is 190 mv minimum, repeat *b*(4) above. If the output is less than 190 mv, proceed to *e* below.

e. Isolation.

(1) Remove all test equipment and reconnect connector P8301 to connector J8301 on assembly A8300.

(2) Remove the cover from assembly A8300.

(3) Perform the general test preparations in paragraph 71. Measure the rf voltage between each junction listed below and chassis ground and compare it with the typical rf voltage listed.

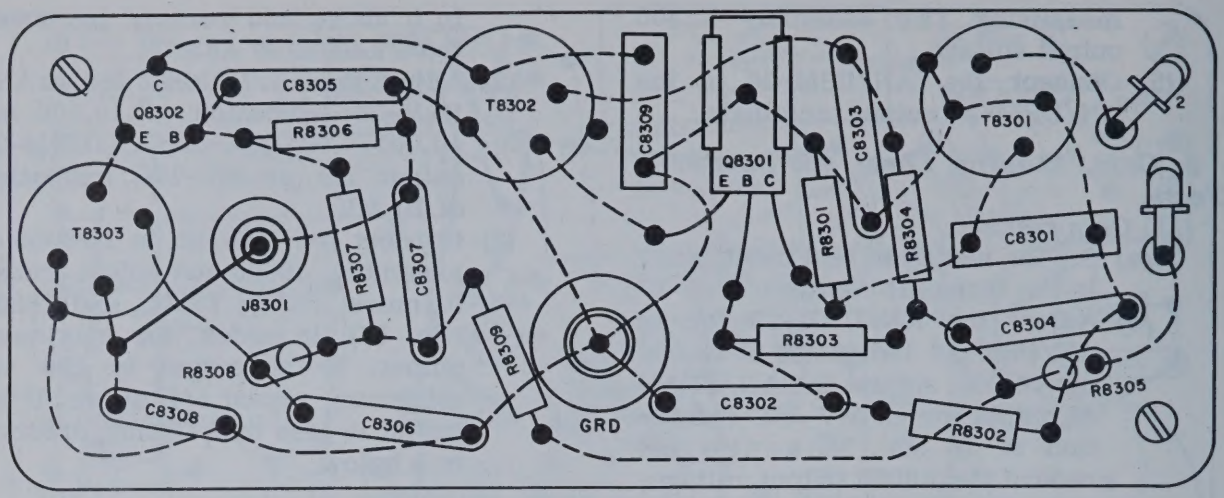
Junction (fig. 52)	Rf volts
J8301 (hot lead)	67 mv
Q8302 emitter	62 mv
Q8302 collector	0.76
Q8301 emitter	160 mv
Q8301 collector	1.9
A8300-2[a]	360 mv

[a] This item refers to the numbered terminal (fig. 52) of assembly A8300.

(4) Measure the dc voltage, use the ME-26B/U, between each junction listed below and chassis ground and compare it with typical dc voltage listed.

Junction (fig. 52)	Dc volts
A8300-1[a] ------	16.0
R8305 and C8304	11.5
R8309 and R8307	10.0
R8308 and T8303	8.6
Q8302 emitter --	8.4
Q8302 base ----	8.2
R8304 and T8302	2.35
Q8301 emitter --	2.34
Q8301 base ----	2.2

[a] This item refers to the numbered terminal (fig. 52) of assembly A8300.



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. --- WIRING ON BACK OF BOARD.
4. ═══ WIRING ON FRONT OF BOARD.

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Figure 52. Assembly A8300, parts location and wiring diagram.

(5) Replace all faulty parts, replace the A8300 cover and repeat *a* through *d* above.

82. Isolating Troubles Within Assembly A8200

Use the following test procedures to check the output voltage and residual voltage. Perform the alignment, signal tracing, and dc voltage measurements. Perform these procedures with assembly A8200 installed in place of the identical assembly in a receiver-transmitter known to be operating properly. Refer to figure 64 for circuit details and to figures 26 and 53 to locate parts and test points.

a. Test Equipment and Additional Equipment Required.

(1) Oscilloscope AN/USM-50A.
(2) RF Signal Generator Set AN/URM-25.
(3) Multimeter ME-26B/U.
(4) RF Vacuum Tube Voltmeter MV-18C (Millivac Instrument Corp.).
(5) Test cable No. 8.
(6) Resistor, 470K, 2 watts, ±5 percent.

b. Preparation.

(1) Make the general test preparations in paragraph 71.
(2) Remove assembly A8400.
(3) Remove connector P8301 from connector J8301 on assembly A8300 (fig. 52) and connect the AN/URM-25 through test cable No. 8 to connector J8301.
(4) Connect the MV-18C to test point TP8003 on assembly A8000 (fig. 26). Connect the 470K resistor between test point TP8002 of assembly A8000 (fig. 26) and chassis ground. Connect the AN/USM-50A across the 470K resistor.

c. Output Level and Residual Voltage Test.

(1) Set the switch of test cable No. 1 in the transmit position.
(2) Adjust the AN/URM-25 for an MV-18C indication of 0.3 volt at a frequency of 11.5 mc. Adjust the AN/URM-25 for maximum amplitude on the AN/USM-50A. A normal AN/USM-50A indication is an amplitude of 15 volts peak-to-peak minimum.
(3) Disconnect the AN/USM-50A, vary the AN/URM-25 frequency from 11.0 to 12.0 mc, and check the residual dc voltage at test point

TP8002 with the ME-26B/U. Ignore ME-26B/U indications between 11.499 and 11.501 mc. A normal indication is ±1.5 volts dc maximum. If this requirement and the requirements in (*a*) above were met the A8200 is operable.

(4) If abnormal indications are obtained, proceed to *e* below. If near normal indications are obtained, proceed to *d* below.

d. Alignment.

(1) Make the test preparations in *b* and *c*(1) and (2) above. Remove the cover from assembly A8200.

(2) Adjust the AN/URM-25 for a beat frequency of 100 cycles or less as indicated by the AN/USM-50A.

(3) Adjust transformers T8201, T8202, and T8204 (fig. 53), in order, for maximum amplitude on the AN/USM-50A. If the output produced is less than 15 volts peak-to-peak, proceed to *e* below. If the output is 15 volts peak-to-peak or more, repeat *c* above.

e. Isolation.

(1) Remove all test equipment and the cover from assembly A8200.

(2) Perform the test preparations in *b*(1), (3) and (4) above.

(3) Adjust the AN/URM-25 for an MV-18C indication of 60 mv at 11.450-mc.

(4) Set the switch of test cable No. 1 in the transmit position.

(5) Measure the ac voltage at each junction listed below, using the ME-26B/U, and compare it with the typical rms voltages listed.

Junction	Rms volts
A8200-3[a] ------	6.5
R8206 and C8208	6.5
R8205 and C8207	9.3
L8202 and C8207	6.4

[a] This item refers to the numbered terminal on the A8200 (fig. 53).

(6) Disconnect the AN/URM-25, measure the rf voltage between each junction listed below and chassis ground, using the MV-18C, and compare it with the typical rf voltage listed.

Junction	Rf volts
A8200-1[a]	230 mv
Q8201 emitter	250 mv
Q8201 collector	2.2
T8203 and R8208	2.8
T8203 and CR8201	2.4

[a] This item refers to the numbered terminal on the A8200 (fig. 53).

(7) Remove assemblies A8100 and A8400; reconnect connector P8201 to connector J8201, measure the rf voltage at each junction listed below and chassis ground, using the MV-18C, and compare it with the typical rf voltages listed.

Junction	Rf volts
A8200-4[a]	320 mv
R8213 and C8212	225 mv
C8210 and T8204	3.0
CR8203 and R8210	4.0

[a] This item refers to the numbered terminal on the A8200 (fig. 53).

(8) Replace assemblies A8100 and A8400, measure the dc voltage between each junction listed below and chassis ground, using the ME-26B/U, and compare it with the typical dc voltages listed.

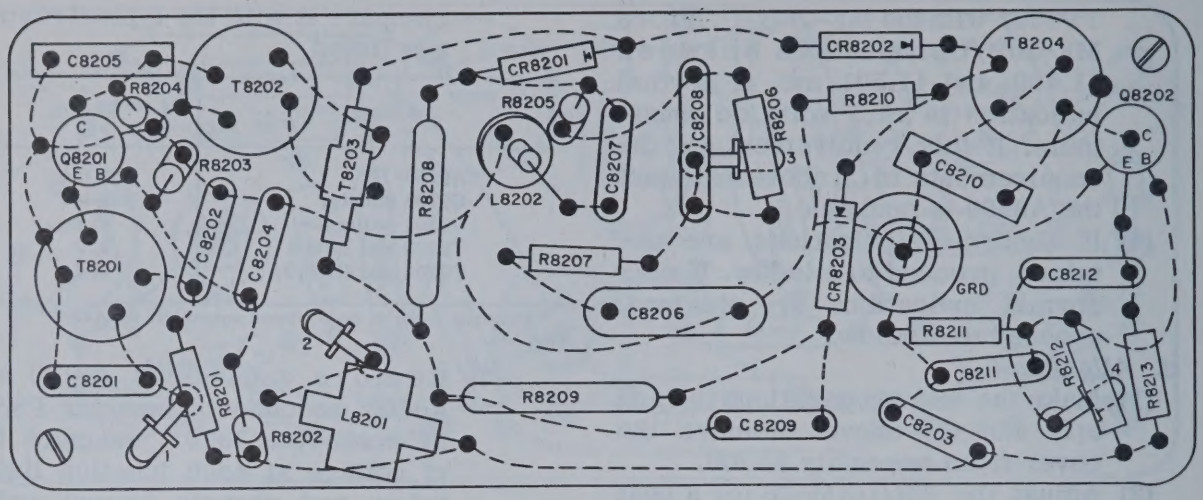
Junction	Dc volts
A8200-2[a] ------	16
R8201 and R8202	15.5
R8201 and C8202	14
Q8201 emitter --	14
R8202 and C8204	14
R8213 and C8212	14
R8212 and R8211	14

[a] This item refers to the numbered terminal on the A8200 (fig. 53).

(9) Replace faulty parts, replace the assembly cover, and repeat *b*, *c*, and *d* above.

83. Isolating Troubles Within Assembly A8400

Use the following test procedures to check output frequency, output voltage, and



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. – – – WIRING ON BACK OF BOARD.
4. ----- PARTS ON FRONT OF BOARD BUT UNDER A PART.

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Figure 53. Assembly A8200, parts location and wiring diagram.

cutoff voltage. Perform signal tracing and make voltage measurements to isolate faulty parts in assembly A8400. Perform these procedures with assembly A8400 installed in place of the identical assembly in a receiver-transmitter known to be operating properly. Refer to figure 64 for circuit details and to figures 26 and 54 to locate parts and test points.

a. *Test Equipment and Additional Equipment Required.*

(1) Multimeter ME-26B/U.
(2) Multimeter TS-352/U.
(3) Oscilloscope AN/USM-50A.
(4) Test assembly No. 1.

b. *Preparation.*

(1) Perform the general test preparations in paragraph 71.
(2) Disconnect connector P8301 from connector J8301 on assembly A8300 (fig. 52).
(3) Connect the output of test assembly No. 1 and the TS-352/U to test point TP8008 on assembly A8000 (fig. 26). Adjust test assembly No. 1 for a TS-352/U indication of 0 volts dc output.
(4) Connect the AN/USM-50A to test point TP8009 (fig. 26) and set the switch of test cable No. 1 in the transmit position.

c. *Output Frequency and Voltage, and Cutoff Voltage Tests.* If abnormal indications are obtained in (1) and (2) below, proceed to c below.

(1) *Output frequency and voltage test.* Calibrate the AN/USM-50A and measure the hunt frequency and peak-to-peak output voltage at test point TP8009. The hunt frequency should be 150 cps ±50 at an amplitude of 7.0 to 10.5 volts peak-to-peak with a risetime greater than, or equal to, the falltime.
(2) *Cutoff voltage test.* Slowly increase the output voltage of test assembly No. 1 in a positive direction until the AN/USM-50A indicates the hunt generator is cut off. A normal indication is a cutoff voltage of +5.5 volts dc maximum as indicated by the TS-352/U.

d. *Isolation.*

(1) Disconnect all test equipment, remove the assembly cover, measure the ac voltage between each junction listed below and chassis ground, using the ME-26B/U, and compare it with the typical ac voltages listed.

Junction (fig. 54)	Ac volts
A8400-4[a]	2.4
L8401 and C8402	2.4
A8400-1[a]	2.4
R8402 and C8405	2.8
C8405 and R8402	11.5
Q8401 emitter	1.7
Q8401 base	1.7
T8401 and C8406	0
A8400-3[a]	0
Q8402 emitter	2.4
R8405, R8407, and R8406	0.2
R8406 and RT8401	0

[a] These items refer to the numbered terminals on the A8400 (fig. 54).

(2) Measure the dc voltage at each junction listed below, using the ME-26B/U, and compare it with the typical dc voltages listed.

Junction (fig. 54)	Dc volts
A8400-3[a]	16
R8407 and R8406	13
R8406 and RT8401	3.5
Q8402 emitter	4.8
Q8401 base	5.6
Q8401 emitter	5.7

[a] This item refers to the numbered terminal on the A8400 (fig. 54).

(3) Replace all faulty parts and the A8400 cover, and repeat *b* and *c* above.

84. Isolating Troubles Within Assembly A7000 (RT-246/VRC)

Use the following test procedures to check actuation time. Perform the dc voltage and signal tracing measurements to isolate faulty parts in assembly A7000. Perform the test procedures on assembly A7000 while it is removed from the receiver-transmitter. Refer to figure 68 for circuit details and to figure 55 to locate parts and test points.

a. Test Equipment Required.

(1) Audio Oscillator TS-382F/U.
(2) Multimeter TS-352/U.
(3) Voltmeter, Electronic ME-30C/U.

b. Preparation.

Note: Transistor Q7001 is a power type, and will not be harmed by resistance measurements if the polarity of the ohmmeter is carefully noted and the procedures carefully followed.

(1) Connect the TS-352/U (as an ohmmeter) OHMS, -DC, ±AC jack test lead to pin K and the OHMS lead to pin D of connector P7001 (fig. 55).
(2) Adjust the TS-382F/U for a frequency of 400 cps with its output control fully counterclockwise and connect its output between pins A and F of connector P7001. Connect the ME-30C/U across the output terminals of the TS-382F/U.

c. Actuation Time Test.

(1) Increase the TS-382F/U 400-cps signal until the TS-352/U indication switches from a high to a low resistance. A normal TS-382F/U indication is a voltage of 3.5 volts ac maximum as indicated by the ME-30C/U.
(2) Remove the TS-382F/U and apply +22.0 volts dc momentarily to pin C of connector P7001. A normal indication is a switching action from a high to a low resistance in approximately 1 second as shown on the TS-352/U.
(3) Repeat (2) above with a 30-volt dc pulse.
(4) Compare the forward and reverse resistances of diodes CR7001 and CR7002 and with those of a new 1N648 diode. Normal indications are similar forward-to-reverse resistance ratios. If these requirements and the requirements in (1), (2), and (3) above were met the A700 is operable.
(5) If abnormal indications are obtained, proceed to *d* below.

d. Isolation.

(1) Apply +25.5 volts dc between pin C and ground (pin K) of P7001, note the voltage at each of the junctions listed, and compare it with the typical dc voltage listed. Check and record the resistances between pins D, H, and L to ground. Connect the TS-352/U OHM, -DC, +AC jack test lead to pin K.

Junction	Dc volts
CR7003 and CR7004	24.5
Q7001 base	24.5

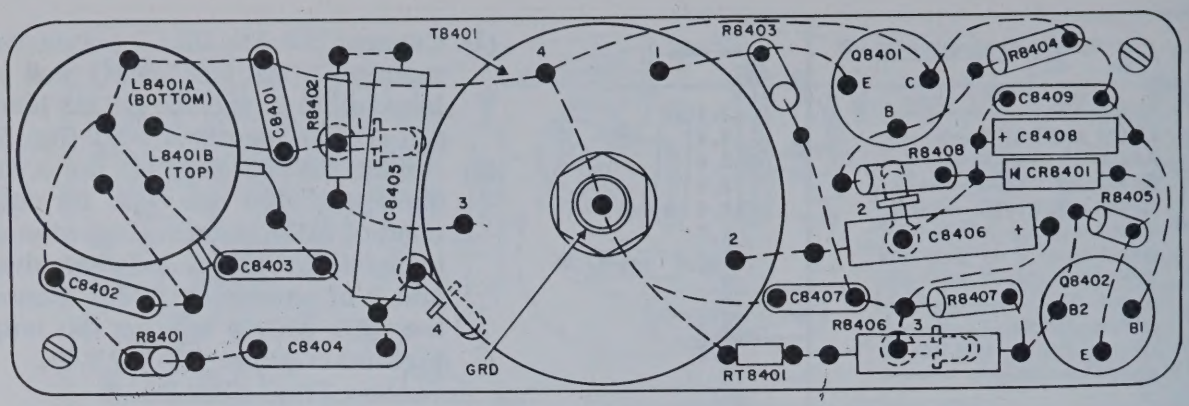


Figure 54. Assembly A8400, parts location and wiring diagram.

(2) Remove the dc voltage from pin C and check to see that the TS-352/U indications are higher than the resistances recorded at pins D, H, and L in (1) above.

(3) Connect the TS-382F/U and the ME-30C/U to pins F and A of connector P7001, adjust for an output of 3.5 volts ac at 400-cps, measure the voltage at each junction listed below, and compare it with the typical ac voltage listed.

Junction	Ac volts
T7001 and CR7003	2.5
CR7003 and CR7004	2.0
Q7001 base	0.6

(4) Replace all faulty parts and repeat *b* and *c* above.

85. Isolating Troubles Within Assembly A7200 (RT-246/VRC Only)

Use the following test procedures to check gain and saturation voltage. Perform the alignment, signal tracing, and dc voltage measurements to isolate faulty parts in assembly A7200. Perform these test and alignment procedures with assembly A7200 removed from the receiver-transmitter. Refer to figure 68 for circuit details and to figure 56 to locate parts and test points.

a. Test Equipment and Additional Equipment Required.

(1) Audio Oscillator TS-382F/U.
(2) Voltmeter, Electronic ME-30C/U.
(3) Multimeter, ME-26B/U.
(4) Multimeter TS-352/U.
(5) Motor Generator MG301.
(6) Dc ammeter, 0-100ma.
(7) Resistor, 1.5-ohm, 10 watt, ±1 percent.

b. Preparation.

Caution: **Do not substitute a powerline-operated meter for the TS-352/U connected between pins H and E of connector P7201.**

(1) Make the test setup shown in figure 57. Operate the TS-352/U as an ac voltmeter.
(2) Adjust the TS-382F/U for 400 cps with an ME-30C/U indication of 12.5 mv ac.

c. Gain and Saturation Voltage Test.

(1) Measure the voltage between pins E and H. A normal indication is a TS-352/U indication of 8.0 volts ac minimum.
(2) Increase the output voltage of the TS-382F/U until no further increase in the TS-352/U is indicated. A normal indication for the saturated condition is a TS-352/U indication of 28 volts ac ±4. If this requirement and the requirement

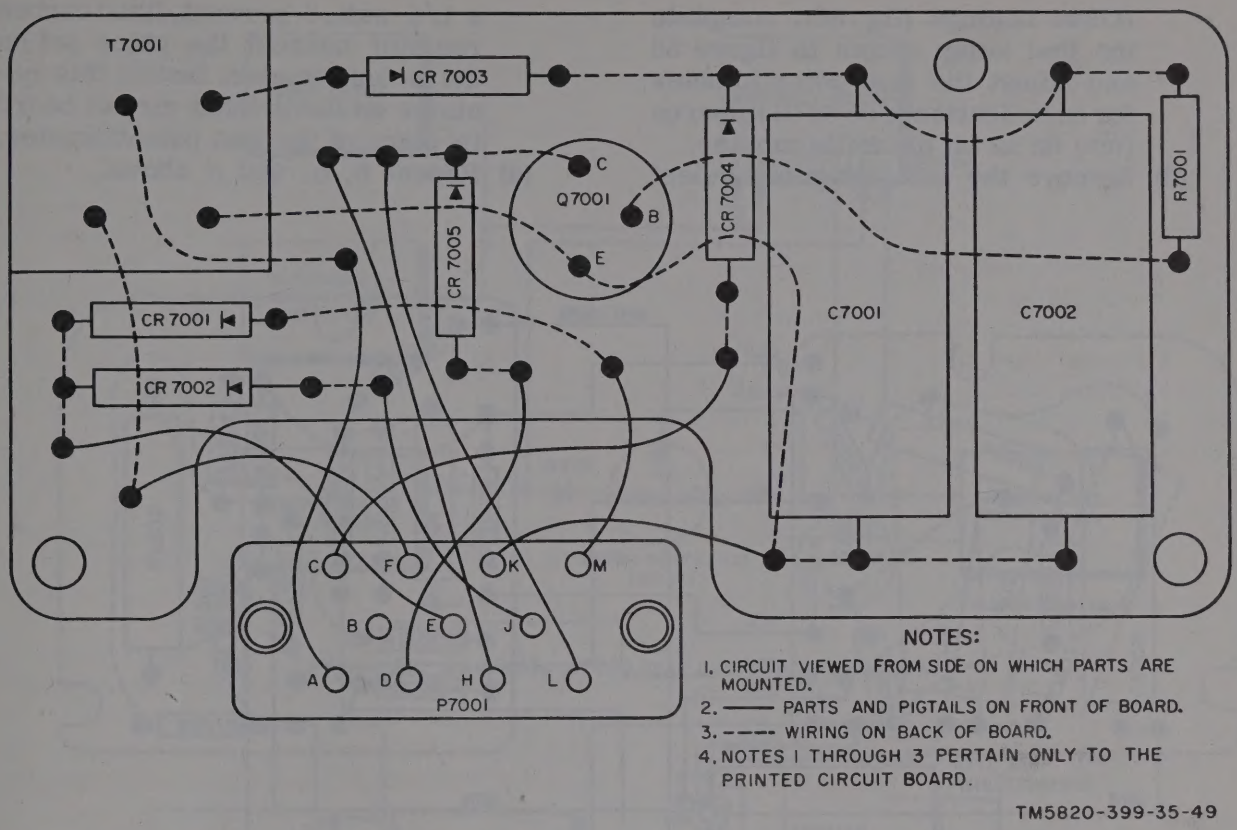


Figure 55. Assembly A7000, parts location and wiring diagram (RT-246/VRC only).

in (1) above were met the A7200 is operable.

(3) If abnormal indications are obtained, proceed to *d* below.

d. Isolation.

(1) Disconnect the TS-352/U and adjust the TS-382F/U for an ME-30C/U indication of 0.03 volt ac. Use the ME-30C/U to measure the ac voltage between each junction listed below and ground and compare it with the typical ac voltage listed.

Junction (fig. 56)	Ac volts
R7201 and CR7201	0.026
Q7203 base -----	0.026
Q7204 base -----	0.23
Q7204 emitter---	0.22
Q7205 collector--	0.4

(2) Disconnect the ME-30C/U and TS-382F/U from the assembly. Use the ME-26B/U to measure the dc voltage between each junction listed below and ground, and compare with the typical dc voltage listed.

Junction	Dc volts
R7202 and R7204	5.1
Q7203 base ----	5.1
Q7203 emitter--	4.6
R7203 and C7203	3.8
Q7205 collector	4.6
Q7205 emitter--	24.0
Q7205 base-----	24.0

(3) If replacement of printed circuit board assembly A7200 is necessary, proceed to *e* below to determine the value of R7204.

(4) Replace all faulty parts and repeat *b* and *c* above.

e. Alignment.

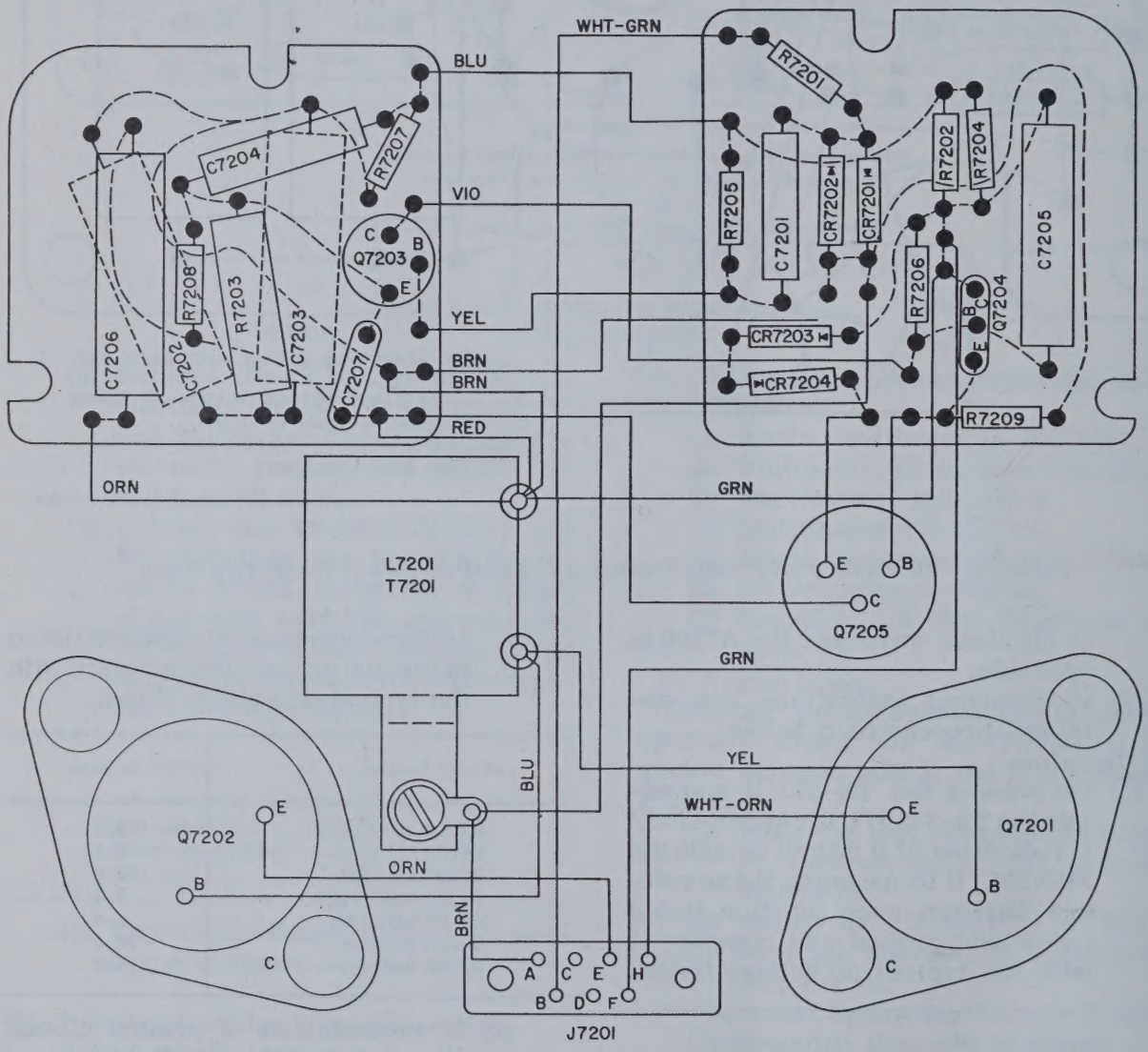
(1) Install the new circuit board in assembly A7200.

(2) Connect a 50K test potentiometer between the points where resistor

R7204 belongs (fig. 56), complete the test setup shown in figure 58 and adjust the test potentiometer for an indication of 55 milliamperes (ma) dc ±2 on the millammeter.

(3) Remove the test setup and select a 1/4-watt, 5-percent, fixed carbon resistor nearest the value set on the potentiometer. Install this resistor on the printed circuit board in place of the test potentiometer.

(4) Repeat *b*, *c*, and *d* above.



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. — — — WIRING ON BACK OF BOARD.
4. – – – – – PARTS ON BACK OF BOARD.
5. NOTES 1 THROUGH 4 PERTAIN ONLY TO THE PRINTED CIRCUIT BOARD.

TM 5820-399-35-50

Figure 56. Assembly A7200, parts location and wiring diagram (RT-246/VRC only).

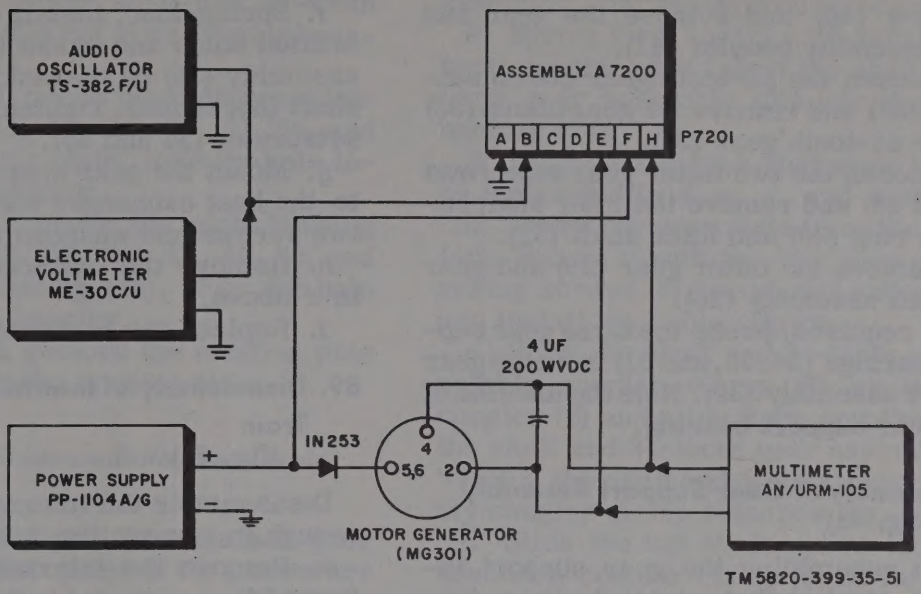


Figure 57. Assembly A7200 test setup, block diagram.

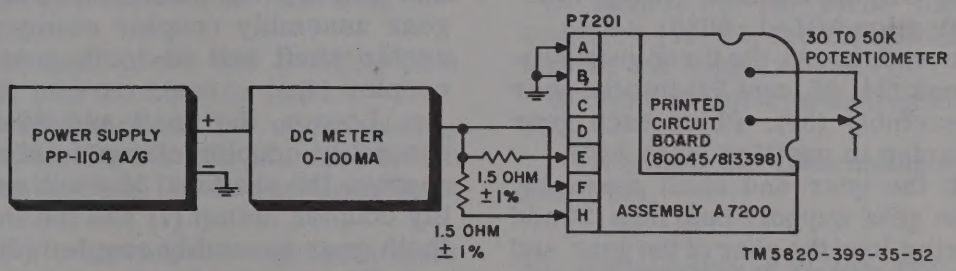


Figure 58. Assembly A7200 alignment test setup, block diagram.

Section III. GEAR TRAIN MAINTENANCE

86. Disassembly and Assembly of Gear Train Assemblies

Do not disassemble the gear trains unless one or more of the tests listed in paragraph 47 or 48 indicate trouble. Perform these tests after assembly to verify that the trouble has been cleared. The antibacklash gear and spring assemblies have been drilled with a No. 55 drill to provide spring-loading calibration holes. Wind the gears to a two- or three-gear tooth deflection, to align the two holes, and insert a pin through the holes when directed in the assembly procedure. Removal of the pin is directed at the appropriate stage of the assembly procedure.

87. Disassembly of Gear Support Assembly (fig. 61)

Disassemble the gear support assembly enough to remove the defective part.

a. Remove the heat exchanger (para 34).

b. Remove the two securing screws and washers (not shown) and remove the gear support assembly (39) from the heat exchanger.

c. Loosen the two 28-tooth gear setscrews (34 and 35) and remove the 28-tooth gear assembly (36) from the heat exchanger tank circuit assembly shaft (not shown).

d. Loosen the gear and shaft assembly

setscrew (40) and remove the gear and shaft assembly coupler (41).

e. Loosen the 28-tooth gear clamp setscrew (38) and remove its gear clamp (33) and the 28-tooth gear (37).

f. Loosen the two miter gear setscrews (27 and 28) and remove the idler shaft retaining ring (30) and idler shaft (32).

g. Remove the miter gear (29) and gear and shaft assembly (26).

h. If required, press the three gear support bearings (24, 25, and 31) from the gear support assembly (39). Note the location of each gear support bearing.

88. Assembly of Gear Support Assembly (fig. 61)

When assembling the gear support assembly, start at that point in the procedure which results in the replacement of the defective part. Lubricate the gear train with Lubricating Oil, Instrument (OA1), Military specification MIL-L-6085.

a. If removed, press the three gear support bearings (24, 25, and 31) into the gear support assembly (39). Place each gear support bearing in position (para 87*h*).

b. Insert the gear and shaft assembly (26) into the gear support bearings (24 and 25) and spring load the gear of the gear and shaft assembly (26) to a one- or two-tooth deflection.

c. Mesh the miter gear (29) with the spring-loaded gear (*b* above) and insert the idler shaft (32) through the gear support bearing (31) and into the miter gear (29). Check to be sure that the two flats on the idler shaft (32) are positioned properly and tighten the two miter gear setscrews (27 and 28). Install the idler shaft retaining ring (30) on the idler shaft.

d. Assemble the 28-tooth gear clamp (33) and the 28-tooth gear (37) and slide them onto the idler shaft (32). Tighten the 28-tooth gear clamp setscrew (38).

e. Mount the gear and shaft assembly coupler (41) on the gear and shaft assembly (26). Check to be sure that the shaft flat is properly positioned. Tighten the gear and shaft assembly coupler setscrew (40). Apply Loctite Grade A cement, American Selant Co., to the gear and shaft assembly coupler setscrew (40).

f. Spring-load, install a pin in the calibration holes and mount the 28-tooth gear assembly (36) on the tank circuit assembly shaft (not shown). Tighten the 28-tooth gear setscrews (34 and 35).

g. Mount the gear support assembly (39) to the heat exchanger and secure with the two screws and washers (not shown).

h. Remove the calibration pin inserted in *f* above.

i. Replace the heat exchanger (para 34).

89. Disassembly of Intermediate Gear Train (fig. 61)

Disassemble the intermediate gear train enough to remove the defective part.

a. Remove the intermediate gear train (para 56).

b. Loosen the center shaft and 32-tooth gear assembly coupler clamp setscrew (3) and remove the center shaft and 32-tooth gear assembly coupler clamp (5) and the center shaft and 32-tooth gear assembly coupler (4).

c. Loosen the shaft and 34-tooth gear assembly coupler clamp setscrew (2) and remove the shaft and 34-tooth gear assembly coupler clamp (7) and the shaft and 34-tooth gear assembly coupler (6).

d. Loosen the rear coupler setscrews and remove the three identical rear couplers (42, 43, and 45).

e. Remove the four gear plate securing screws (8) (one shown), washers, and cable clip (9) and remove the gear plate (1).

f. Slide the shaft and 66-tooth gear assembly (55) out of its housing bearing (54).

g. Slide the right shaft and 32-tooth gear assembly (49) out of its housing bearing (48).

h. Slide the shaft and 76-tooth gear assembly (18) out of its housing bearing (47).

i. Slide the shaft and 34-tooth gear assembly (19) out of its housing bearing (21).

j. Slide the shaft and 15- and 68-tooth gear assembly (57) out of its housing bearing (53).

k. Slide the shaft and 42-tooth gear assembly (59) out of its housing bearing (15).

l. Slide the left shaft and 32-tooth gear assembly (13) out of its housing bearing (14).

m. Slide the center shaft and 32-tooth gear assembly (52) out of its housing bearing (17).

n. If required, press the eight gear plate bearings (10, 11, 12, 16, 50, 51, 56, and 58) out of the gear plate. Note the hole location of each bearing.

o. If required, press the eight housing bearings (14, 15, 17, 21, 47, 48, 53, and 54) from the housing (46). Note the hole location of each bearing.

p. If required, remove the locating pins (22 and 44) from the housing (46).

90. Assembly of Intermediate Gear Train (fig. 61)

When assembling the intermediate gear train, start at that point in the procedure which replaces the defective part. Lubricate the gear train with oil (OA1), Military specification MIL-L-6085. Test the intermediate gear train before and after replacement.

a. If removed, press the locating pins (22 and 44) into the housing (46).

b. If removed, press the eight housing bearings (14, 15, 17, 21, 47, 48, 53, and 54) into the housing. Place each bearing in position.

c. If removed, press the eight gear plate bearings (10, 11, 12, 16, 50, 51, 56, and 58) into the gear plate. Place each bearing in the position noted in paragraph 89*n*.

d. Spring load, insert a pin into the calibration holes, and insert the center shaft and 32-tooth gear assembly (52) into its housing bearing (17).

e. Spring load, insert a pin into the calibration holes, and insert the left shaft and 32-tooth gear assembly (13) into its housing bearing (14).

f. Insert the shaft and 42-tooth gear assembly (59) into its housing bearings (15).

g. Spring load, insert a pin in the calibration holes, and insert the shaft and 15- and 68-tooth gear assembly (57) into its housing bearing (53).

h. Insert the shaft and 34-tooth gear assembly (19) into its housing bearing (21).

i. Insert the shaft and 76-tooth gear assembly (18) into its housing bearing (47).

j. Insert the right shaft and 32-tooth gear assembly (49) into its housing bearing (48).

k. Spring load, insert a pin into the calibration holes, and insert the shaft and 66-tooth gear assembly (55) into its housing bearing (54).

l. Remove the pins that were installed as instructed in *d*, *e*, *g*, and *k* above.

m. Mount the gear plate (1) on the housing (46). Secure it with the four gear plate securing screws (8) (one shown) and washers, and install the cable clip (9).

n. Slide the shaft and 34-tooth gear assembly coupler clamp (7) on the shaft coupler (6) and slide them onto the shaft of the shaft and 34-tooth gear assembly (19). Tighten the shaft and 34-tooth gear assembly coupler clamp setscrew (2).

o. Slide the left shaft and 32-tooth gear assembly coupler clamp (5) on its coupler (4) and slide them onto the shaft of the left shaft and 32-tooth gear assembly (13). Tighten the coupler clamp setscrew (3).

p. Replace the three identical rear couplers (42, 43, and 45) on their shafts and tighten the coupler setscrews.

q. Test the intermediate gear train (para 47).

r. Replace the intermediate gear train (para 56).

91. Disassembly of RT-246/VRC Front-Panel Gear Train (fig. 62)

Disassemble the gear train enough to remove the defective part.

a. Remove the front-panel gear train (para 55).

b. Loosen the coupler and miter gear clamp setscrew (81) and remove the coupler and miter gear clamp (83) and the coupler and miter gear (82).

c. Loosen the coupler clamp setscrew (79) and remove the coupler clamp (84) and the coupler (80).

d. Disengage the detent arm spring (85) from the detent arm (109) and remove the detent arm spring (85) and the detent arm spring pin (86).

e. Remove the detent arm retaining ring (87) and the detent arm (109). Remove the detent arm post (108).

f. Loosen the detent gear setscrew (110)

and slide off the kc detent gear (77) and the detent spacer (78).

g. Remove the solenoid securing screws (113) (only one shown), lockwashers (112), and the solenoid assembly (111).

h. Remove the band switch arm retaining ring (106), band switch arm retaining screw (88), band switch arm spacer (89), and band switch arm washer (90). Remove the band switch arm (91), and remove the band switch arm retaining ring (105).

i. Loosen the three motor generator clamps (92) (only one shown), and remove the motor generator (107).

j. Loosen the coupler and 47-tooth gear assembly clamp setscrew (103) and remove the 47-tooth gear assembly coupler clamp (99) and the coupler and 47-tooth gear assembly (102).

k. Remove the two potentiometer securing screws (98) (only one shown) and potentiometer lockwashers (97) and remove the potentiometer (95) and potentiometer retainer (96).

l. Loosen the 21-tooth potentiometer gear setscrew (100) and slide the 21-tooth potentiometer gear (101) off the potentiometer (95) shaft.

m. If required, loosen the six stripper bolts (93) (one shown removed) and remove the stripper bolts and capnuts (94). The stripper bolts have left-hand threads.

n. Mark the tooth engagement of the channel-selector mask (9) and the band switch gear (10). Also, mark the angular position of the band switch gear to the band switch shaft (13).

o. Remove the band switch gear retaining ring (8) from the band switch shaft (13). Loosen the two band switch gear setscrews (11) (only one shown) on the band switch gear (10). Slide the band switch gear (10) off the band switch shaft (13).

p. Disengage the mask spring (2) from the mask assembly (6). Remove the mask spring (2) and the mask spring pin (1).

q. Loosen the two cam and 72-tooth gear assembly setscrews (74) (only one shown), and simultaneously slide the mc-dial and gear assembly (12) and the cam and 72-tooth gear assembly (73) upward until they are free of the mc shaft and 52-tooth gear assembly (25) and the kc shaft and 15- and 45-tooth gear assembly (21), respectively. Observe the gear mesh marks on the cam and 72-tooth gear assembly (73) and the dial assembly 72-tooth kc gear (72). These marks must match when the units are reassembled.

r. If required, disassemble the mc dial assembly as follows:

(1) Remove the dial assembly 72-tooth kc gear retaining ring (3), shims (4 and 5) from the dial assembly 72-tooth kc gear (72).

(2) Remove, in order, the mask assembly (6), mask assembly shim (7), the channel-selector mask (9), kc dial shim (76), kc dial (75), and mc dial and gear assembly (12) from the dial assembly 72-tooth kc gear (72).

s. Slide the 25-tooth gear (71) off the left shaft and 20-tooth gear assembly (50).

t. Remove the three 110-tooth gear securing screws (14) (only one shown) and washers (15) and remove the 110-tooth gear (16) from the mc shaft and 52-tooth gear assembly (25). Remove the left shaft and 20-tooth gear assembly retaining ring (70) from the left shaft and 20-tooth gear assembly (50).

u. Remove the two lower gear plate securing screws (17) (only one shown) and lower gear plate securing screw washers (18) and removefthe lower gear plate (19).

v. Remove the center gear plate securing screws (69) (only one shown) and center gear plate securing screw washers (68) and remove the center gear plate (67).

w. Remove the two right gear plate securing screws (66) (only one shown) and right gear plate securing screw washers (65) and remove the right gear plate (64).

x. Slide the 120-tooth gear assembly (22) and 120-tooth gear assembly spacer (23) off the mc shaft and 52-tooth gear assembly (25).

y. Withdraw the mc shaft and 52-tooth gear assembly (25) from the housing bearing (36).

z. If required, disassemble the mc shaft and 52-tooth gear assembly (25) as follows:

(1) Remove the detent ball (24) and unsolder the wire lead to the spring and contact assembly (28).

(2) Drill out the two spring and contact assembly rivets (29) (only one shown) from the mc shaft and 52-tooth gear assembly (25).

(3) Remove the spring and contact assembly (28) and the mc detent spring (26) from the mc shaft and 52-tooth gear assembly (25).

aa. Withdraw the kc shaft and 15- and 45-tooth gear assembly (21) from its housing bearing (51).

ab. Withdraw the shaft and 37-tooth gear assembly (54) from its housing bearing (52).

ac. Withdraw the shaft and 15- and 45-tooth gear assembly (55) from its housing bearing (53).

ad. Withdraw the shaft and 54-tooth gear assembly (58) from its housing bearing (57).

ae. Withdraw the shaft and 15- and 110-tooth gear assembly (59) from its housing bearing (56).

af. Withdraw the left shaft and 60-tooth gear assembly (35) from its housing bearing (39).

ag. Withdraw the right shaft and 60-tooth gear assembly (44) from its housing bearing (41).

ah. Withdraw the right shaft and 26- and 44-tooth gear assembly (45) from its housing bearing (42).

ai. Withdraw the left shaft and 20-tooth gear assembly (50) from its housing bearing (37).

aj. Withdraw the left shaft and 26- and 44-tooth gear assembly (34) from its housing bearing (38).

ak. Withdraw the right shaft and 20-tooth gear assembly (46) from its housing bearing (43).

al. Withdraw the band switch shaft (13) from its housing bearing (33). Remove the roll pin (32) and slide the band switch shaft arm (31) off the band switch shaft (13).

am. Remove and tag the parts of the blade assembly (104).

an. If required, press the two lower gear plate bearings (20 and 27) from the lower gear plate (19).

ao. If required, press the four center gear plate bearings (30, 47, 60, and 63) from the center gear plate (67).

ap. If required, press the four right gear plate bearings (48, 49, 61, and 62) from the right gear plate (64).

aq. If required, press the 13 housing bearings (33, 36, 37, 38, 39, 41, 42, 43, 51, 52, 53, 56, and 57) from the housing (40).

92. Assembly of RT-246/VRC Front Panel Gear Train

(fig. 62)

When assembling the gear train, start at that point in the procedure which replaces the defective part. Lubricate the gear train with oil (OA1), Military specification MIL-L-6085.

a. If removed, slide each of the six cap-nuts (94) (one shown removed) on their stripper bolts (93). Apply Loctite Grade A cement, American Sealant Co., to the stripper bolt threads and screw the stripper bolts into the housing.

b. If removed, press the 13 housing bearings (33, 36, 37, 38, 39, 41, 42, 43, 51, 52, 53, 56, and 57) into the housing (40); press the two lower gear plate bearings (20 and 27) into the lower gear plate (19); press the four center gear plate bearings (30, 47, 60, and 63) into the center gear plate (67) and press the four right gear plate bearings (48, 49, 61, and 62) into the right gear plate (64).

c. Place the housing (40) front down and mount the blade assembly (104), dismounted and tagged in paragraph 91*am*. Place the housing front up.

d. Mount the band switch shaft arm (31) on the band switch shaft (13) and secure with the roll pin (32). The marks scribed in disassembly must be aligned. Insert the band switch shaft (13) into its housing bearing (33).

e. Mount the band switch arm (91); use the band switch arm retaining rings (105 and 106), band switch arm spacer (89), band switch arm washer (90), and band switch arm retaining screw (88).

f. Insert the right shaft and 20-tooth gear assembly (46) into its housing bearing (43).

g. Spring load, install a pin in the calibration holes, and insert the right shaft and 26- and 44-tooth gear assembly (45) into its housing bearing (42).

h. Insert the left shaft and 20-tooth gear assembly (50) into its housing bearing (37).

i. Spring load, install a pin in the calibration holes, and insert the left shaft and 26- and 44-tooth gear assembly (34) into its housing bearing (38).

j. Spring load, install a pin in the calibration holes, and insert the left shaft and 60-tooth gear assembly (35) into its housing bearing (39).

k. Spring load, install a pin in the calibration holes, and insert the right shaft and 60-tooth gear assembly (44) into its housing bearing (41).

l. Spring load, install a pin in the calibration holes, and insert the shaft and 15- and 45-tooth gear assembly (55) into its housing bearing (53).

m. If disassembled, assemble the mc shaft and 52-tooth gear assembly (25) as follows:

(1) Assemble, in order, the mc detent spring (26) and the spring and contact assembly (28) on the mc shaft and 52-tooth gear assembly (25). Rivet with two spring and contact assembly rivets (29) (only one shown).

(2) Solder the wire lead to the spring and contact assembly (28) terminal.

n. Insert the mc shaft and 52-tooth gear assembly (25) into its housing bearing (36).

o. Install the detent ball (24) into the hole of the mc shaft and 52-tooth gear assembly (25). Install the 120-tooth gear assembly spacer (23) on the hub of the mc shaft and 52-tooth gear assembly (25).

p. Spring load, install a pin in the calibration holes of the 120-tooth gears, and slide the 120-tooth gear assembly (22) onto the mc shaft and 52-tooth gear assembly (25).

q. Insert the kc shaft and 15- and 45-tooth gear assembly (21) into its housing bearing (51).

r. Insert the shaft and 37-tooth gear assembly (54) into its housing bearing (52).

s. Insert the shaft and 15- and 110-tooth gear assembly (59) into its housing bearing (56).

t. Insert the shaft and 54-tooth gear assembly (58) into its housing bearing (57).

u. Align the lower gear plate (19) with the guide pins and press down into position. Secure the plate with the two lower gear plate securing screws (17) (only one shown) and washers (18).

v. Install the left shaft and 20-tooth gear assembly retaining ring (70). Align the center gear plate (67) with the guide pins and press down into position. Secure with the two center gear plate securing screws (69) (only one shown) and washers (68).

w. Align the right gear plate (64) with the guide pins and press down into position. Secure with the two left gear plate securing screws (66) (only one shown) and washers (65).

x. Position the 110-tooth gear (16) on the 120-tooth gear assembly (22) and secure with the three 110-tooth gear securing screws (14) (only one shown) and washers (15).

y. Slide the 25-tooth gear (71) on the left shaft and 20-tooth gear assembly (50).

z. Remove the pins from the calibration holes (*g*, *i*, *j*, *l*, and *p* above).

aa. If disassembled, assemble the dial assembly as follows:

(1) Set the dial assembly 72-tooth kc gear (72) hub side up and slide the mc dial and gear assembly (12) onto the hub.

(2) Press the kc dial (75) onto the knurled hub of the dial assembly 72-tooth kc gear (72).

(3) Assembly in order, the kc dial shim (76), the channel-selector mask (9), mask assembly shim (7), the mask assembly (6), and shims (5 and 4) on the dial assembly 72-tooth kc gear (72) hub.

(4) Install the dial assembly 72-tooth kc gear retaining ring (3).

ab. Align the hole in the dial assembly 72-tooth kc gear (72) with the mark on the cam and 72-tooth gear assembly (73) and engage its cam and the cam follower on the mask assembly (6). Slide the entire combination into position. The dial assembly slides onto the mc shaft and 52-tooth gear assembly (25) and the cam and 72-tooth gear assembly (73) slides onto the kc shaft and 15- and 45-tooth gear assembly (21). Tighten the two cam and 72-tooth gear assembly setscrews (74).

ac. Mount the band switch gear (10) on the band switch shaft (13). Check to be sure that the band switch gear (10) meshes with the channel-selector mask (9) as marked before disassembly. Check to be sure that the position of the band switch gear on the band switch shaft (13) is also as marked before disassembly. Tighten the two band switch gear setscrews (11) (only one shown) on the band switch gear (10). Install the band switch gear retaining ring (8).

ad. Mount the mask spring pin (1) onto the housing and connect the mask spring (2) to the mask spring pin and to the mask assembly (6).

ae. Assemble the coupler and miter gear clamp (83) and the coupler and miter gear (82) and slide them onto their shaft. Tighten the coupler and miter gear clamp setscrew (81).

af. Screw the detent arm post (108) into the housing (40), mount the detent arm (109), and install the detent arm retaining ring (87).

ag. Slide the kc detent gear (77) on its shaft and tighten the detent gear setscrew (110). Slide the detent spacer (78) onto the shaft.

ah. Install the detent arm spring pin (86). Engage the detent arm spring (85) to the detent arm (109) and the detent arm spring pin (86).

ai. Press the coupler clamp (84) onto the coupler (80) and slide them onto the shaft. Tighten the coupler clamp setscrew (79).

aj. Mount the solenoid assembly (111) and secure with the solenoid securing screws (113) (only one shown) and lockwashers (112).

ak. Press the 47-tooth gear assembly coupler clamp (99) onto the coupler and 47-tooth gear (102) and slide them onto the shaft. Tighten the coupler and 47-tooth gear assembly coupler clamp setscrew (103).

al. Mount the motor generator (107) and tighten three motor generator clamps (92) (only one shown).

am. Slide the 21-tooth potentiometer gear (101) on the potentiometer (95) shaft and tighten the 21-tooth potentiometer gear setscrew (100). Check to be sure that the potentiometer shaft is in the proper position of its rotational range.

an. Spring load the 21-tooth potentiometer gear (101) two teeth before engaging it with the coupler and 47-tooth gear assembly (102). Mount the potentiometer (95) and the potentiometer retainer (96) and secure with the potentiometer securing screws (98) (only one shown) and lockwashers (97).

ao. Replace the front-panel gear train (para 55).

ap. Test the front-panel gear train (para 48).

93. Disassembly of RT-524/VRC Front Panel Gear Train
(fig. 63)

Disassemble the gear train enough to remove the defective part.

a. Remove the front panel (para 32) and front-panel gear train (para 55). Place the front panel on its handles.

b. Remove the band switch detent assembly consisting of the band switch detent sleeve (40), detent ball (44), detent spring (45), and detent spring setscrew (46). Remove the kc detent assembly consisting of the kc detent sleeve (87), kc detent ball (86), kc detent spring (85), and kc detent spring setscrew (84).

c. Mark the tooth engagement of the channel-selector mask (9) and the band switch gear (10). Also mark the angular position of the band switch gear (10) to the band switch shaft (13).

d. Remove the band switch gear retaining ring (8) from the band switch shaft (13), and loosen the two band switch gear setscrews (11) (only one shown) on the band switch gear (10). Slide the band switch gear (10) off the band switch shaft (13).

e. Disengage the mask spring (2) from the mask assembly (6). Remove the mask spring (2) and the mask spring pin (1).

f. Loosen the two cam and 72-tooth gear assembly setscrews (81) and simultaneously slide the mc-dial and gear assembly (12) and the cam and 72-tooth gear assembly (80) upward until they are free of the mc shaft and 52-tooth gear assembly (26) and the kc shaft and 15- and 45-tooth gear assembly (69) respectively. Observe the gear mesh marks on the cam and 72-tooth gear

assembly (80) and the dial assembly 72-tooth kc gear (79). These marks must match when the units are reassembled.

g. If required, disassemble the mc dial and gear assembly (12) as follows:

(1) Remove the dial assembly 72-tooth kc gear retaining ring (3) from the dial assembly 72-tooth kc gear (79).

(2) Remove, in order, the shims (4 and 5), the mask assembly (5), mask assembly shim (7), the channel-selector mask (9), kc dial shim (83), kc dial (82), and mc dial and gear assembly (12) from the dial assembly 72-tooth kc gear (79).

h. Slide the 25-tooth gear (78) off the left shaft and 20-tooth gear assembly (31).

i. Remove three 110-tooth gear assembly securing screws (14) (only one shown) and washers (15) and remove the 110-tooth gear (16) from the mc shaft and 52-tooth gear assembly (26).

j. Remove the shaft and 20-tooth gear assembly retaining ring (17) and the two lower gear plate securing screws (18) (only one shown) and washers (19). Remove the lower gear plate (20).

k. Remove the two center gear plate securing screws (77) (only one shown) and washers (76) and remove the center gear plate (75).

l. Remove the two right gear plate securing screws (74) and washers (73) and remove the right gear plate (72).

m. Slide the 120-tooth gear assembly (23) and spacer (24) off the mc shaft and 52-tooth gear assembly (26).

n. Withdraw the mc shaft and 52-tooth gear assembly (26) from its housing bearing (38).

o. If required, disassemble the mc shaft and 52-tooth gear assembly as follows:

(1) Remove the mc detent ball (25) and unsolder the wire lead to the spring and contact assembly (29).

(2) Drill out the two spring and contact assembly rivets (30) (only one shown) from the mc shaft and 52-tooth gear assembly (26).

(3) Remove the spring and contact assembly (29) and mc detent spring (27) from the mc shaft and 52-tooth gear assembly (26).

p. Withdraw the kc shaft and 15- and 45-tooth gear assembly (69) from its housing bearing (64).

q. Loosen the kc detent gear setscrew (47) and remove the kc detent gear (51) and the detent stop assembly (52).

r. Withdraw the shaft and 37-tooth gear assembly (68) from its housing bearing (65).

s. Withdraw the shaft and 15- and 45-tooth gear assembly (67) from its housing bearing (66).

t. Withdraw the left shaft and 60-tooth gear assembly (33) from its housing bearing (53).

u. Withdraw the right shaft and 60-tooth gear assembly (60) from its housing bearing (54).

v. Withdraw the right shaft and 26- and 44-tooth gear assembly (58) from its housing bearing (56).

w. Withdraw the left shaft and 20-tooth gear assembly (31) from its housing bearing (55).

x. Withdraw the left shaft and 26- and 44-tooth gear assembly (32) from its housing bearing (37).

y. Withdraw the right shaft and 20-tooth gear (59) from its housing bearing (57).

z. Remove the band switch arm retaining rings (41 and 42), band switch arm securing screw (50) and washer (49), and band switch arm spacer (48), and remove the band switch arm (43).

aa. Withdraw the band switch shaft (13) from its housing bearing (36). Remove the roll pin (35) and slide the band switch shaft detent arm (34) off the band switch shaft (13).

ab. Remove and tag the parts of the blade assembly (88).

ac. If required, press the two lower gear plate bearings (21 and 28) from the lower gear plate (20).

ad. If required, press the four bearings (22, 63, 70, and 71) from the center gear plate (75).

ae. If required, press the two right gear plate bearings (61 and 62) from the right gear plate (72).

af. If required, press the 11 housing bearings (36, 37, 38, 53, 54, 55, 56, 57, 64, 65, and 66) from the housing (39).

94. Assembly of RT-524/VRC Front Panel Gear Train (fig. 63)

When assembling the gear train, start at that point in the procedure which replaces the defective part. Lubricate the gear train with oil (OA1), Military Specification MIL-L-6085.

a. If removed, press the 11 housing bearings (36, 37, 38, 53, 54, 55, 56, 57, 64, 65, and 66) into the housing (39); press the two housing bearings (61 and 62) into the right gear plate (72); press the four housing bearings (22, 63, 70, and 71) into the center gear plate (75); and press the two housing bearings (21 and 28) into the lower gear plate (20).

b. Place the housing front down and mount the blade assembly (88) that was tagged as instructed in paragraph 93*ab*.

c. Mount the band switch shaft detent arm (34) on the band switch shaft (13) and secure with the roll pin (35). Align the marks that were scribed in disassembly. Insert the band switch shaft (13) into its housing bearing (36).

d. Mount the band switch arm (43); use the two band switch arm retaining rings (41 and 42), band switch arm spacer (48), band switch arm securing screw washer (49), and screw (50).

e. Insert the right shaft and 20-tooth gear assembly (59) into its housing bearing (57).

f. Spring load, install a pin in the calibration holes, and insert the right shaft and 26- and 44-tooth gear assembly (58) into its housing bearing (56).

g. Insert the left shaft and 20-tooth gear assembly (31) into its housing bearing (55).

h. Spring load, install a pin in the calibration holes, and insert the left shaft and 26- and 44-tooth gear assembly (32) into its housing bearing (37).

i. Spring load, install a pin in the calibration holes, and insert the left shaft and 60-tooth gears (33) into its housing bearing (53).

j. Spring load, install a pin in the calibration holes, and insert the right shaft and 60-tooth gear assembly (60) into its housing bearing (54).

k. Spring load, install a pin in the calibration holes, and insert the shaft and 15- and 45-tooth gear assembly (67) into its housing bearing (66).

l. If disassembled, assemble the mc shaft and 52-tooth gear assembly (26) as follows:

(1) Assemble, in order, the mc detent spring (27) and the spring and contact assembly (29) on the shaft plate. Rivet by using two spring and contact assembly rivets (30) (only one shown).

(2) Solder the wire lead to the spring and contact assembly (29) terminal.

m. Insert the mc shaft and 52-tooth gear assembly (26) into its housing bearing (38).

n. Install the mc detent ball (25) into the hole of the mc shaft and 52-tooth gear assembly (26). Install the 120-tooth gear assembly spacer (24) on the hub of the mc shaft and 52-tooth gear assembly.

o. Spring load, install a pin in the calibration holes of the 120-tooth gears, and slide the spacer (24) and the 120-tooth gear assembly (23) onto the mc shaft and 52-tooth gear assembly (26).

p. Insert the kc shaft and 15- and 45-tooth gear assembly (69) into its housing bearing (64).

q. Insert the shaft and 37-tooth gear assembly (68) into its housing bearing (65).

r. Align the lower gear plate (20) with the guide pins and press down into position. Secure the plate with the two lower gear plate securing screws (18) and washers (19). Install the shaft and 20-tooth gear assembly retaining ring (17).

s. Align the center gear plate (75) with the guide pins and press down into position. Secure it with the two center gear plate securing screws (77) (only one shown) and washers (76).

t. Align the right gear plate (72) with the guide pins and press down into position. Secure it with the two right gear plate screws (74) and washers (73).

u. Position the 110-tooth gear assembly (16) on the 120-tooth gear assembly (23) and secure with three 110-tooth gear securing screws (14) (only one shown) and washers (15).

v. Slide the 25-tooth gear (78) on the left shaft and 20-tooth gear assembly (31).

w. Remove the pins from the calibration holes (*f*, *h*, *i*, *j*, *k*, and *o* above).

x. If disassembled, assemble the mc dial assembly as follows:

(1) Place the dial assembly 72-tooth kc gear (79) hub side up and slide the mc dial and gear assembly (12) onto the hub of the dial assembly 72-tooth kc gear (79).

(2) Press the kc dial (82) onto the knurl of the dial assembly 72-tooth kc gear (79).

(3) Assemble in order, the kc dial shim (83), the channel-selector mask (9), mask assembly shim (7), the mask assembly (6), and shims (5 and 4) on the dial assembly 72-tooth gear hub.

(4) Install the dial assembly 72-tooth gear retaining ring (3).

y. Match the hole in the dial assembly 72-tooth gear (79) with the mark on the 72-tooth gear of the cam and 72-tooth gear assembly (80) and engage its cam with the mask assembly (6) cam. Slide the entire combination onto its shafts. The dial assembly (12) slides onto the mc shaft and 52-tooth gear assembly (26) and the cam and 72-tooth gear assembly (80) slides onto the kc shaft and 15- and 45-tooth gear assembly (69). Tighten the two cam and 72-tooth gear assembly setscrews (81) (only one shown).

z. Mount the band switch gear (10) on the band switch shaft (13). Check to be sure that the band switch gear (10) meshes with the channel-selector mask (9) as marked before disassembly. Check to be sure that the position of the band switch gear (10) on the band switch shaft (13) is also as marked before disassembly. Tighten the two band switch gear setscrews (11) (only one shown) and install the retainer ring (8).

aa. Mount the mask spring pin (1) onto the housing (39) and connect the mask spring (2) to the mask spring pin (1) and to the mask assembly (6).

ab. Replace the front-panel gear train (para 55).

ac. Install the housing band switch detent assembly, consisting of the band switch detent sleeve (40), detent ball (44), detent spring (45), and detent spring setscrew (46), as follows:

(1) Screw the band switch detent sleeve (40) into the housing.

(2) Insert the detent ball (44) and the detent spring (45) into the band switch detent sleeve (40). Screw the detent spring setscrew (46) into the band switch detent sleeve (40).

(3) Adjust the detent spring setscrew (46) from the maximum out position while measuring the band switch control shaft torque. The detent spring setscrew (46) adjustment is correct when the band switch control shaft torque is 40 to 45 inch-ounce.

ad. Replace the detent stop assembly (52) and the kc detent gear (51) on the shaft. Secure with the kc detent gear setscrew (47).

ae. Install the housing kc detent assembly, consisting of the kc detent sleeve (87), kc detent ball (86), kc detent spring (85) and kc detent spring setscrew (84), as follows:

(1) Screw the kc detent sleeve (87) into the housing.

(2) Insert the kc detent ball (86) and the kc detent spring (85) into the detent sleeve. Screw the kc detent spring setscrew (84) into the detent sleeve.

(3) Adjust the kc detent spring setscrew (84) from the maximum out position while measuring the shaft torque. The setscrew adjustment is correct when the shaft torque is 30 to 35 inch-ounce.

af. Replace the front-panel gear train (para 55).

ag. Perform the front-panel gear train test (para 48).

APPENDIX

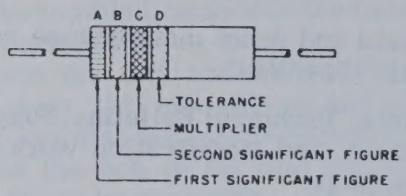
REFERENCES

Following is a list of references available to the field and depot maintenance repairman of Receiver-Transmitters, Radio RT-246/VRC and RT-524/VRC.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders
TA 11-17	Signal Field Maintenance Shops
TA 11-100 (11-17)	Allowances of Signal Corps Expendable Supplies for Signal Maintenance Shops
TM 11-1257	Signal Generator AN/URM-48
TM 11-5057	Frequency Meter AN/USM-26
TM 11-5097	Spectrum Analyzers TS-723A/U, TS-723B/U, and TS-723C/U
TM 11-5126	Power Supplies PP-1104A/G and PP-1104B/G
TM 11-5129	Oscilloscopes AN/USM-50A, B, and C
TM 11-5133	Radio Frequency Wattmeter AN/URM-43A
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U
TM 11-5551	Instruction Book for RF Signal Generator Set AN/URM-25
TM 11-5820-399-35P	Field and Depot Maintenance Repair Parts and Special Tool Lists, Receiver-Transmitter, Radio RT-246/VRC
TM 11-5820-401-10	Operator's Manual; Radio Sets AN/VRC-12 AND AN/VRC-43, -44, -45, -46, -47, -48 and -49
TM 11-5820-401-20	Organizational Maintenance Manual; Radio Sets AN/VRC-12 and AN/VRC-43, -44, -45, -46, -47, -48, AND -49
TM 11-5820-401-35	Field and Depot Maintenance Manual; Radio Sets AN/VRC-12 AND AN/VRC-43, -44, -45, -46, -47, -48, and -49
TM 11-5820-409-35	Field and Depot Maintenance Manual; Receiver, Radio R-442/VRC
TM 11-5820-487-35P	Field and Depot Maintenance Repair Parts and Special Tool Lists, Receiver-Transmitter, Radio RT-524/VRC
TM 11-6625-200-12	Operator and Organizational Maintenance Manual; Multimeters ME-26A/U and ME-26B/U
TM 11-6625-261-12	Operator's and Organizational Maintenance Manual; Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U
TM 11-6625-320-12	Operator's and Organizational Maintenance Manual; Voltmeter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U

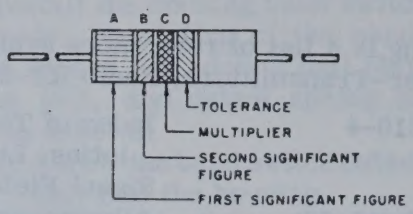
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS

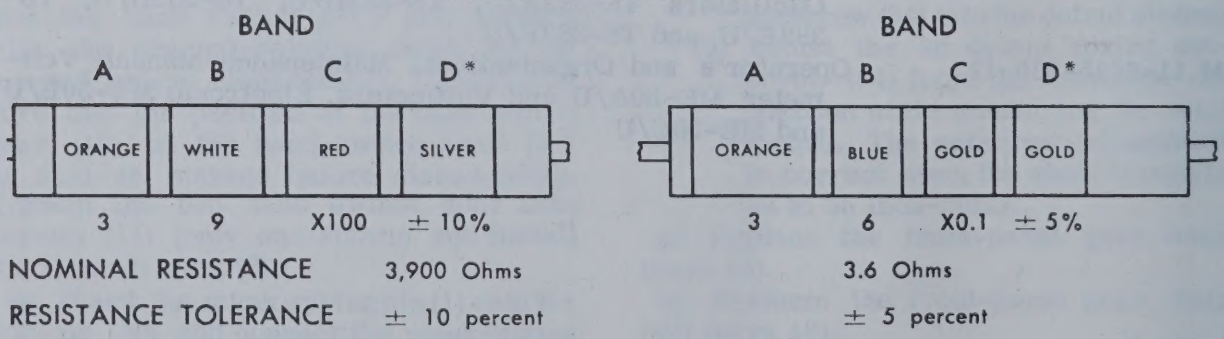


BAND A— Double Width Signifies Wire-wound Resistor

COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING



*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

Figure 59. MIL-STD resistor color code marking.

COLOR CODE TABLES

Y and CB

CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
		± 20%	± 20%		A				−55° to +70°C	10–55 cps
				B	E		B			
%		± 2%	± 2%	C		C			−55° to +85°C	
	± 30%			D			D	300		
				E					−55° to +125°C	10–2,000 cps
%				F				500		
									−55° to +150°C	
		± 5%	± 5%							
%	± 10%	± 10%	± 10%							

, Style CK

CAPACITANCE TOLERANCE	MIL ID
± 20%	
± 10%	
	CK

TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

ant (SIG) figures are multiplied to obtain the capacitance in uuf.

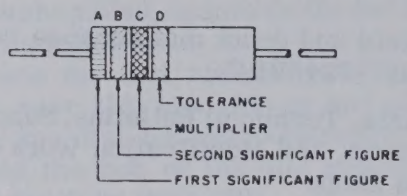
cable specifications: MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.

nperature limits designated in MIL–C–11015.

e centigrade.

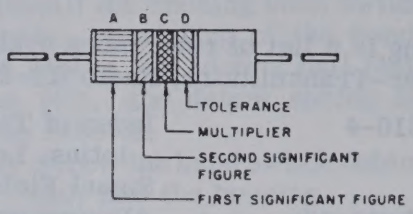
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS

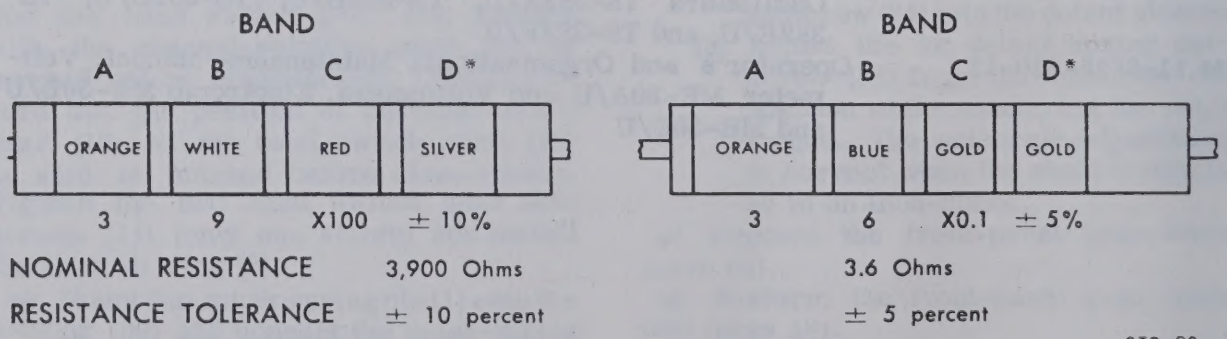


BAND A— Double Width Signifies Wire-wound Resistor

COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING

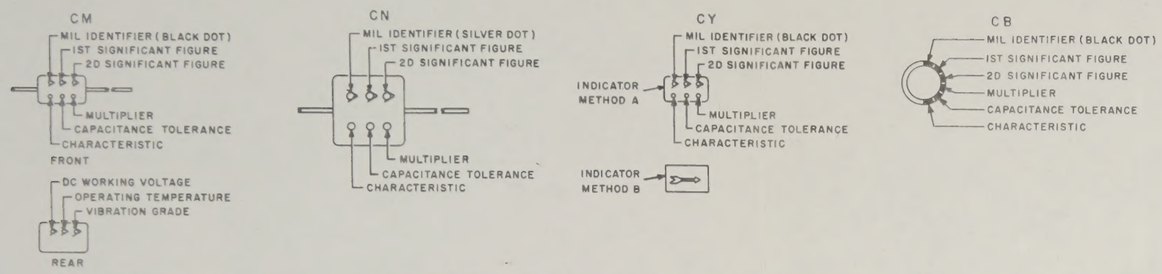


*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

Figure 59. MIL-STD resistor color code marking.

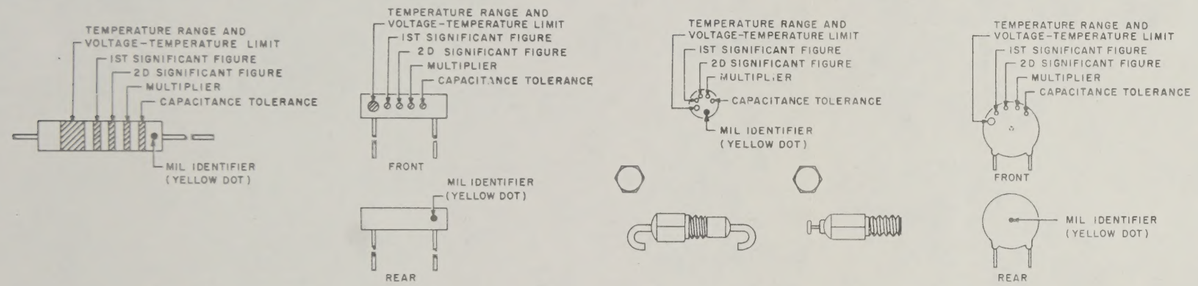
COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



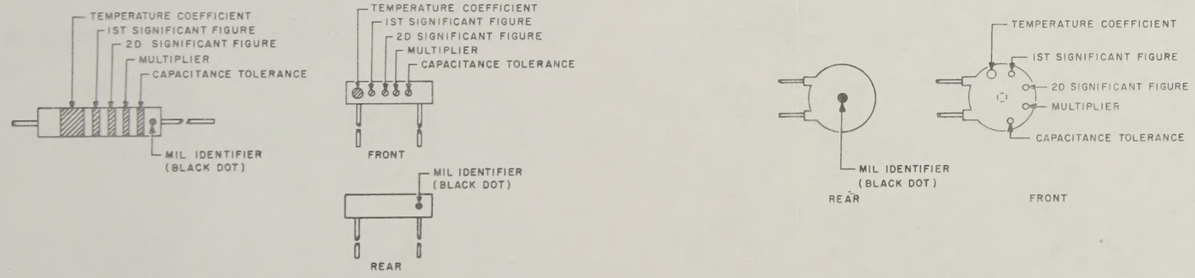
MICA-DIELECTRIC | PAPER-DIELECTRIC | GLASS-DIELECTRIC, GLASS CASE | MICA, BUTTON TYPE

GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



AXIAL LEAD | RADIAL LEAD | FEED-THROUGH | STAND-OFF | DISK-TYPE

GROUP III Capacitors, Fixed, Ceramic-Dieletric (Temperature Compensating) Style CC



AXIAL LEAD | RADIAL LEAD | DISK-TYPE

Figure 60. MIL-STD capacitor color code marking.

COLOR CODE TABLES

TABLE I – For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY CB	0	0	1			± 20%	± 20%		A				−55° to +70°C	10–55 cps
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C			−55° to +85°C	
ORANGE		3	3	1,000		± 30%			D			D	300		
YELLOW		4	4	10,000					E					−55° to +125°C	10–2,000 cps
GREEN		5	5		± 5%				F				500		
BLUE		6	6											−55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

TABLE II – For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE – TEMP. LIMITS[3]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BV	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL–C–11015.
4. Temperature coefficient in parts per million per degree centigrade.

	27 Miter gear setscrew
y coupler	28 Miter gear setscrew
	29 Miter gear
ıssembly	30 Idler shaft retaining ring
	31 Gear support bearing
ıssembly coupler	32 Idler shaft
ıssembly	33 28-tooth gear clamp
	34 28-tooth setscrew
y coupler	35 28-tooth setscrew
y coupler clamp	36 28-tooth gear assembly
	37 28-tooth gear
	38 28-tooth gear clamp setscrew
y gear	39 Gear support assembly
	40 Gear and shaft assembly coupler setscrew
ıssembly	41 Gear and shaft assembly coupler
	42 Rear coupler
ɜembly	43 Rear coupler
	44 Locating pin
ɜembly	45 Coupler
ɜembly	46 Housing
	47 Shaft and 76-tooth gear assembly housing bearing
y housing	
	48 Right shaft and 32-tooth gear assembly housing bearing
y gear	
	49 Right shaft and 32-tooth gear assembly
ıssembly	50 Right shaft and 32-tooth gear assembly gear plate bearing
y	51 Shaft and 76-tooth gear assembly gear plate bearing
y	
	52 Center shaft and 32-tooth gear assembly
y housing	53 Shaft and 15- and 68-tooth gear assembly housing bearing
	54 Shaft and 66-tooth gear assembly housing bearing
ɛear support	55 Shaft and 66-tooth gear assembly
	56 Gear plate bearing
ɐar support	57 Shaft and 15- and 68-tooth gear assembly
	58 Gear plate bearing
	59 Shaft and 42-tooth gear assembly

1 Gear plate
2 Shaft and 34-tooth gear assembly coupler clamp setscrew
3 Center shaft and 32-tooth gear assembly coupler clamp setscrew
4 Center shaft and 32-tooth gear assembly coupler
5 Center shaft and 32-tooth gear assembly coupler clamp
6 Shaft and 34-tooth gear assembly coupler
7 Shaft and 34-tooth gear assembly coupler clamp
8 Gear plate securing screw
9 Cable clip
10 Shaft and 42-tooth gear assembly gear plate bearing
11 Center shaft and 32-tooth gear assembly gear plate bearing
12 Left shaft and 32-tooth gear assembly gear plate bearing
13 Left shaft and 32-tooth gear assembly
14 Left shaft and 32-tooth gear assembly housing bearing
15 Shaft and 42-tooth gear assembly housing bearing
16 Shaft and 34-tooth gear assembly gear plate bearing
17 Center shaft and 32-tooth gear assembly housing bearing
18 Shaft and 76-tooth gear assembly
19 Shaft and 34-tooth gear assembly
20 Band switch motor gear
21 Shaft and 76-tooth gear assembly housing bearing
22 Locating pin
23 Band switch motor
24 Gear and shaft assembly front gear support bearing
25 Gear and shaft assembly rear gear support bearing
26 Gear and shaft assembly
27 Miter gear setscrew
28 Miter gear setscrew
29 Miter gear
30 Idler shaft retaining ring
31 Gear support bearing
32 Idler shaft
33 28-tooth gear clamp
34 28-tooth setscrew
35 28-tooth setscrew
36 28-tooth gear assembly
37 28-tooth gear
38 28-tooth gear clamp setscrew
39 Gear support assembly
40 Gear and shaft assembly coupler setscrew
41 Gear and shaft assembly coupler
42 Rear coupler
43 Rear coupler
44 Locating pin
45 Coupler
46 Housing
47 Shaft and 76-tooth gear assembly housing bearing
48 Right shaft and 32-tooth gear assembly housing bearing
49 Right shaft and 32-tooth gear assembly
50 Right shaft and 32-tooth gear assembly gear plate bearing
51 Shaft and 76-tooth gear assembly gear plate bearing
52 Center shaft and 32-tooth gear assembly
53 Shaft and 15- and 68-tooth gear assembly housing bearing
54 Shaft and 66-tooth gear assembly housing bearing
55 Shaft and 66-tooth gear assembly
56 Gear plate bearing
57 Shaft and 15- and 68-tooth gear assembly
58 Gear plate bearing
59 Shaft and 42-tooth gear assembly

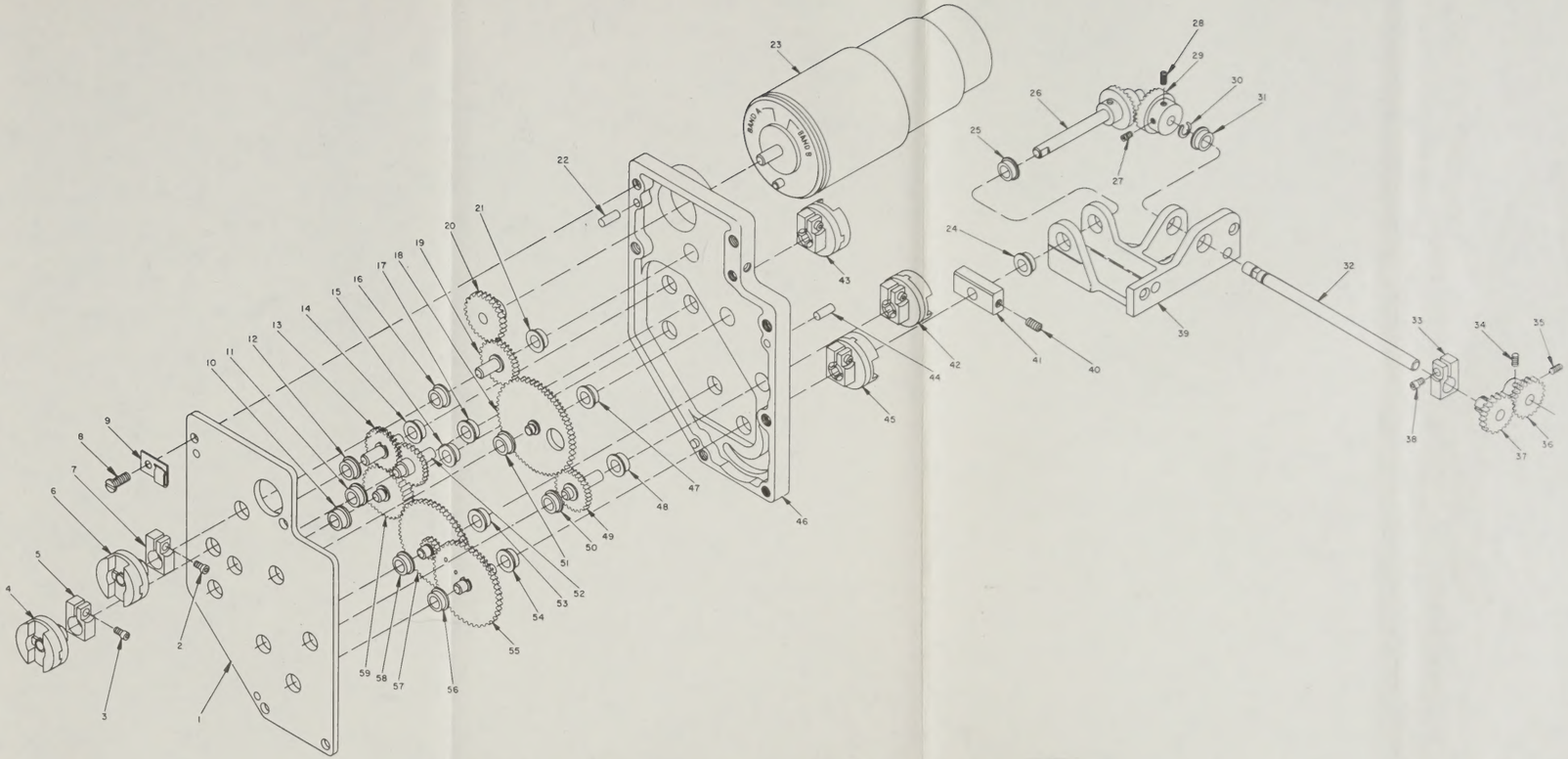
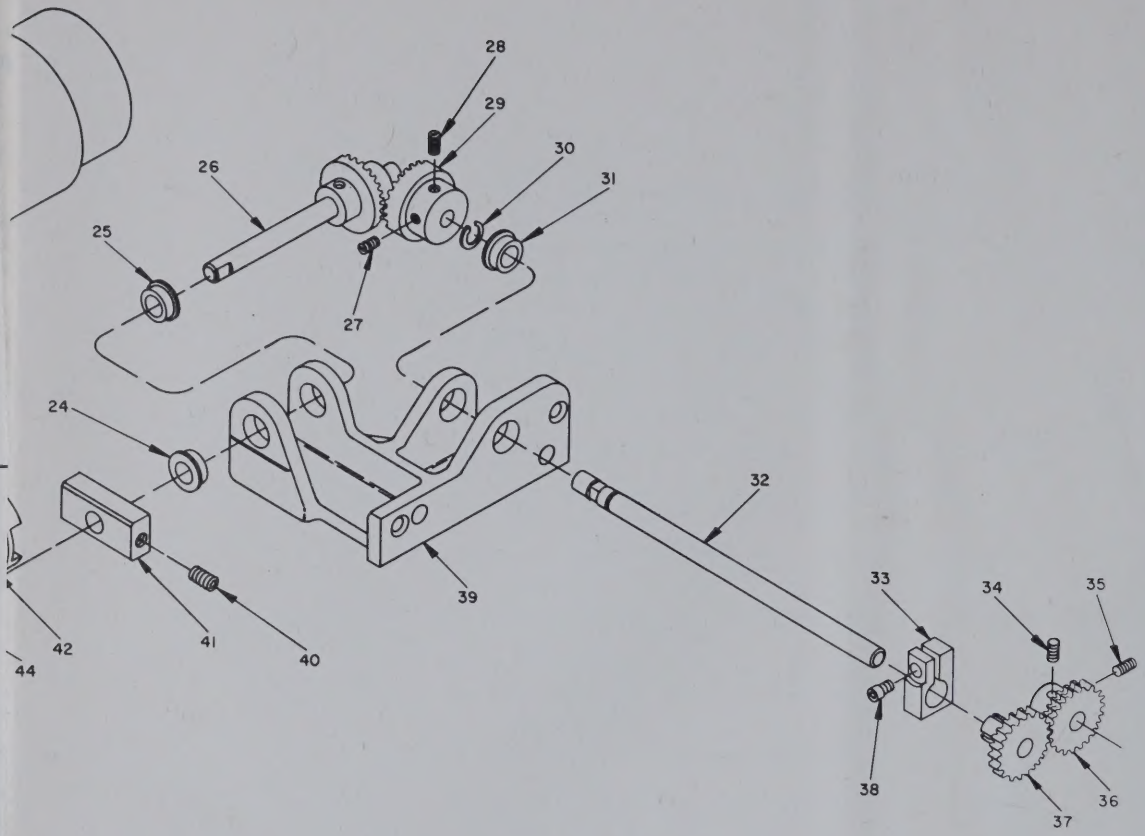


Figure 61. Gear support and intermediate gear train assemblies, exploded view.

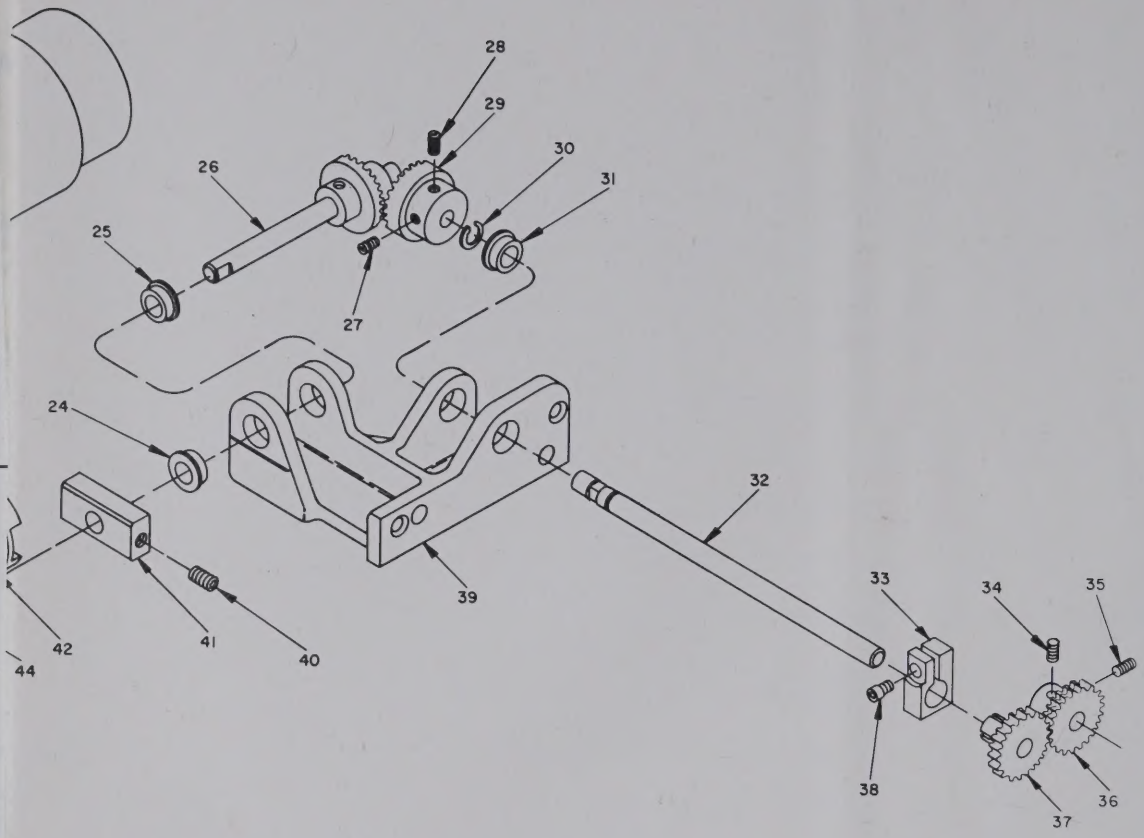
TM5820-399-35-33



oded view.

TM5820-399-35-33

58 Shaft and 54-tooth gear assembly
59 Shaft and 15- and 110-tooth gear assembly
g ring 60 Center gear plate bearing
61 Right gear plate bearing
62 Right gear plate bearing
63 Center gear plate bearing
64 Right gear plate
65 Right gear plate securing screw washer
66 Right gear plate securing screw
67 Center gear plate
68 Center gear plate securing screw washer
69 Center gear plate securing screw
70 Left shaft and 20-tooth gear assembly retaining ring
71 25-tooth gear
72 Dial assembly 72-tooth kc gear
73 Cam and 72-tooth gear assembly
74 Cam and 72-tooth gear assembly setscrew
75 Kc dial
76 Kc dial shim
mbly 77 Kc detent gear
78 Detent spacer
79 Coupler clamp setscrew
80 Coupler
81 Coupler and miter gear clamp setscrew
82 Coupler and miter gear
83 Coupler and miter gear clamp
84 Coupler clamp
85 Detent arm spring
86 Detent arm spring pin
87 Detent arm retaining ring
88 Band switch arm retaining screw
89 Band switch arm spacer
embly 90 Band switch arm washer
91 Band switch arm
92 Motor generator clamp
93 Stripper bolt
94 Capnut
95 Potentiometer
96 Potentiometer retainer
97 Potentiometer lockwasher
98 Potentiometer securing screw
99 47-tooth gear assembly coupler clamp
100 21-tooth potentiometer gear setscrew
sembly 101 21-tooth potentiometer gear
102 Coupler and 47-tooth gear assembly
103 Coupler and 47-tooth gear assembly clamp setscrew
104 Blade assembly
105 Band switch arm retaining ring
106 Band switch arm retaining ring
107 Motor generator
108 Detent arm post
109 Detent arm
y 110 Detent gear setscrew
111 Solenoid assembly
112 Lockwasher
113 Solenoid securing screw



oded view.

TM5820-399-35-33

1 Mask spring pin
2 Mask spring
3 Dial assembly 72-tooth kc gear retaining ring
4 Shim
5 Shim
6 Mask assembly
7 Mask assembly shim
8 Band switch gear retaining ring
9 Channel-selector mask
10 Band switch gear
11 Band switch gear setscrew
12 Mc dial and gear assembly
13 Band switch shaft
14 110-tooth gear securing screw
15 Washer
16 110-tooth gear
17 Lower gear plate securing screw
18 Lower gear plate securing screw washer
19 Lower gear plate
20 Lower gear plate bearing
21 Kc shaft and 15- and 45-tooth gear assembly
22 120-tooth gear assembly
23 120-tooth gear assembly spacer
24 Detent ball
25 Mc shaft and 52-tooth gear assembly
26 Mc detent spring
27 Lower gear plate bearing
28 Spring and contact assembly
29 Spring and contact assembly rivet
30 Center gear plate bearing
31 Band switch shaft arm
32 Roll pin
33 Housing bearing
34 Left shaft and 26- and 44-tooth gear assembly
35 Left shaft and 60-tooth gear assembly
36 Housing bearing
37 Housing bearing
38 Housing bearing
39 Housing bearing
40 Housing
41 Housing bearing
42 Housing bearing
43 Housing bearing
44 Right shaft and 60-tooth gear assembly
45 Right shaft and 26- and 44-tooth gear assembly
46 Right shaft and 20-tooth gear assembly
47 Center gear plate bearing
48 Right gear plate bearing
49 Right gear plate bearing
50 Left shaft and 20-tooth gear assembly
51 Housing bearing
52 Housing bearing
53 Housing bearing
54 Shaft and 37-tooth gear assembly
55 Shaft and 15- and 45-tooth gear assembly
56 Housing bearing
57 Housing bearing
58 Shaft and 54-tooth gear assembly
59 Shaft and 15- and 110-tooth gear assembly
60 Center gear plate bearing
61 Right gear plate bearing
62 Right gear plate bearing
63 Center gear plate bearing
64 Right gear plate
65 Right gear plate securing screw washer
66 Right gear plate securing screw
67 Center gear plate
68 Center gear plate securing screw washer
69 Center gear plate securing screw
70 Left shaft and 20-tooth gear assembly retaining ring
71 25-tooth gear
72 Dial assembly 72-tooth kc gear
73 Cam and 72-tooth gear assembly
74 Cam and 72-tooth gear assembly setscrew
75 Kc dial
76 Kc dial shim
77 Kc detent gear
78 Detent spacer
79 Coupler clamp setscrew
80 Coupler
81 Coupler and miter gear clamp setscrew
82 Coupler and miter gear
83 Coupler and miter gear clamp
84 Coupler clamp
85 Detent arm spring
86 Detent arm spring pin
87 Detent arm retaining ring
88 Band switch arm retaining screw
89 Band switch arm spacer
90 Band switch arm washer
91 Band switch arm
92 Motor generator clamp
93 Stripper bolt
94 Capnut
95 Potentiometer
96 Potentiometer retainer
97 Potentiometer lockwasher
98 Potentiometer securing screw
99 47-tooth gear assembly coupler clamp
100 21-tooth potentiometer gear setscrew
101 21-tooth potentiometer gear
102 Coupler and 47-tooth gear assembly
103 Coupler and 47-tooth gear assembly clamp setscrew
104 Blade assembly
105 Band switch arm retaining ring
106 Band switch arm retaining ring
107 Motor generator
108 Detent arm post
109 Detent arm
110 Detent gear setscrew
111 Solenoid assembly
112 Lockwasher
113 Solenoid securing screw

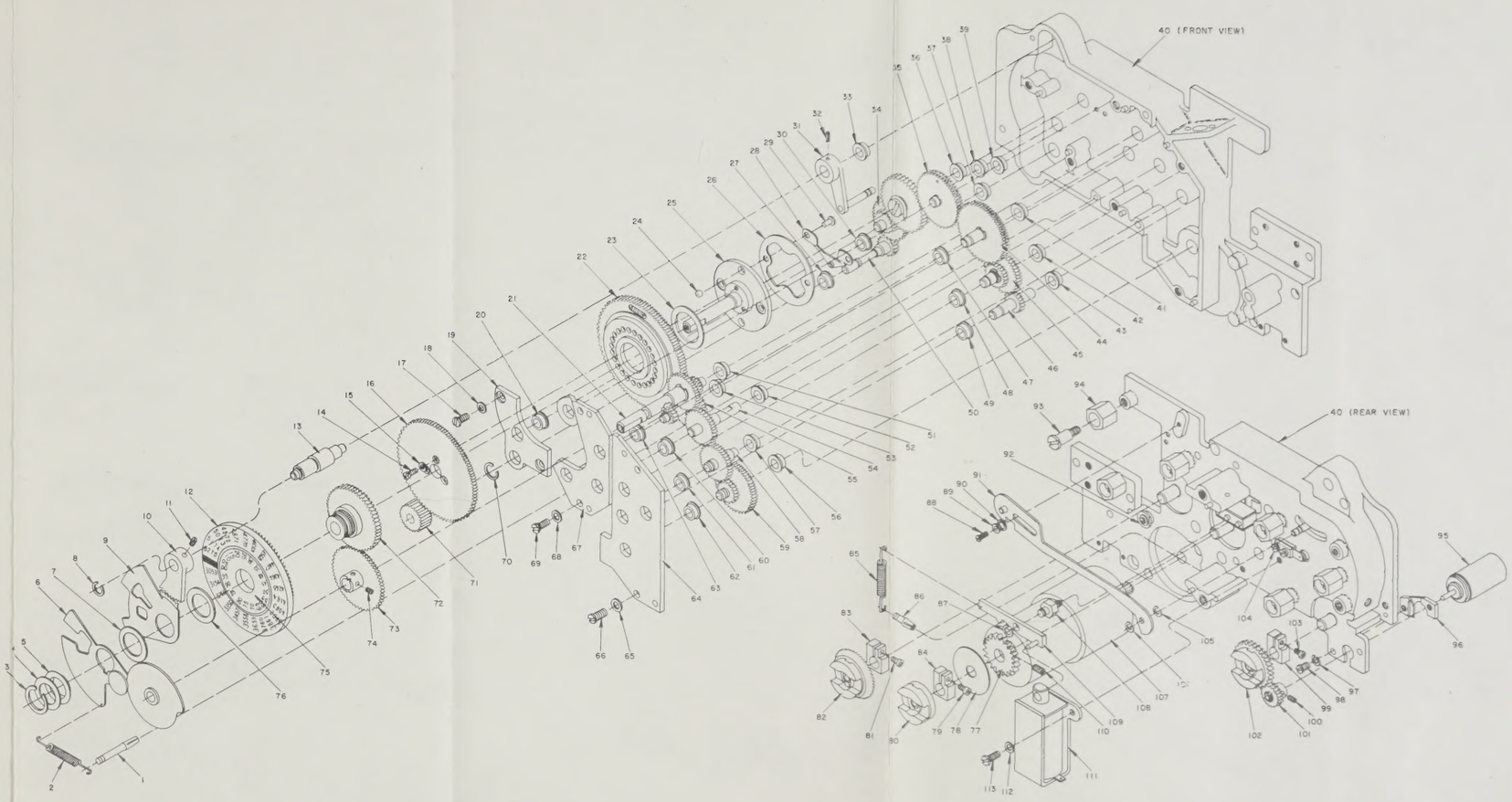
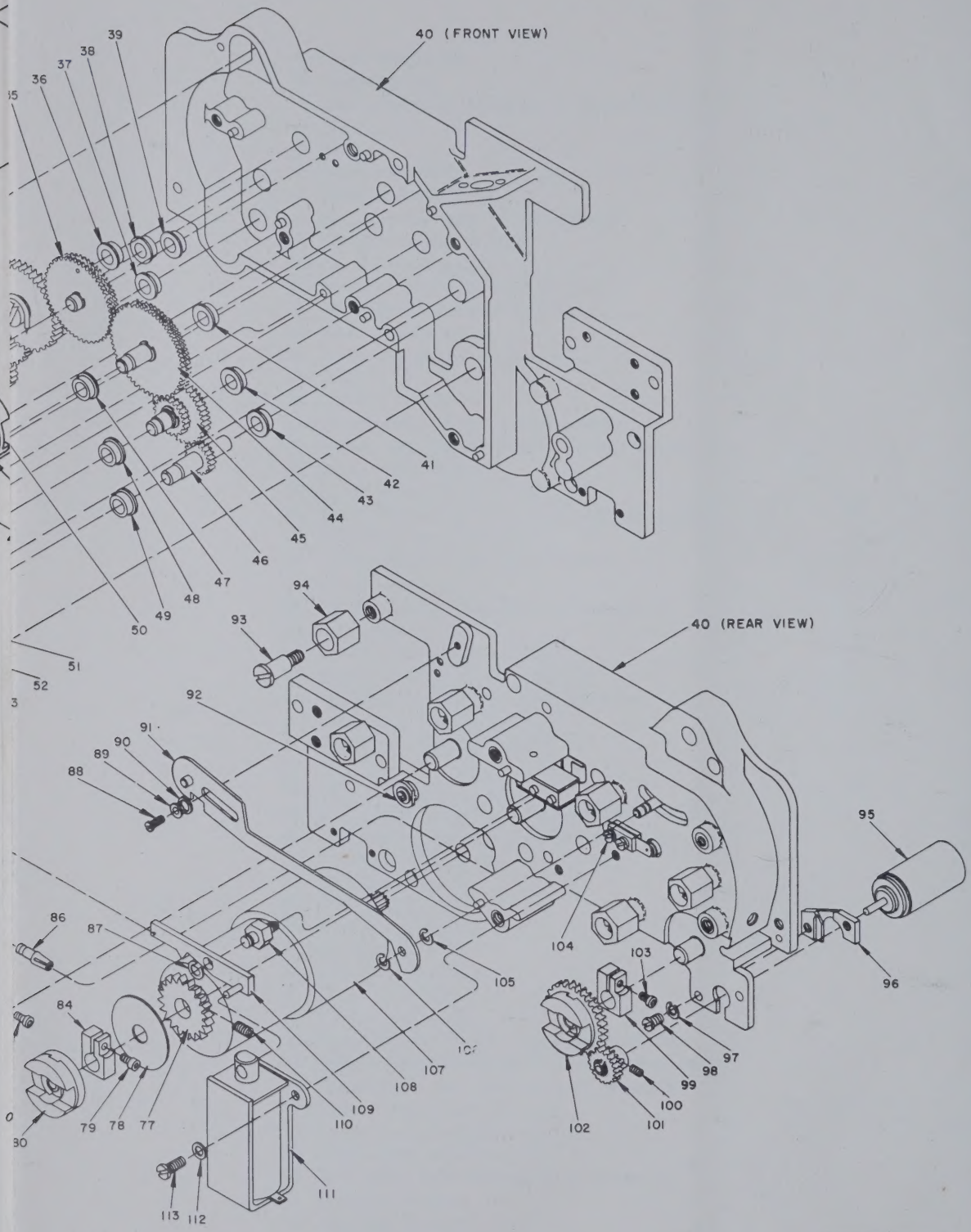
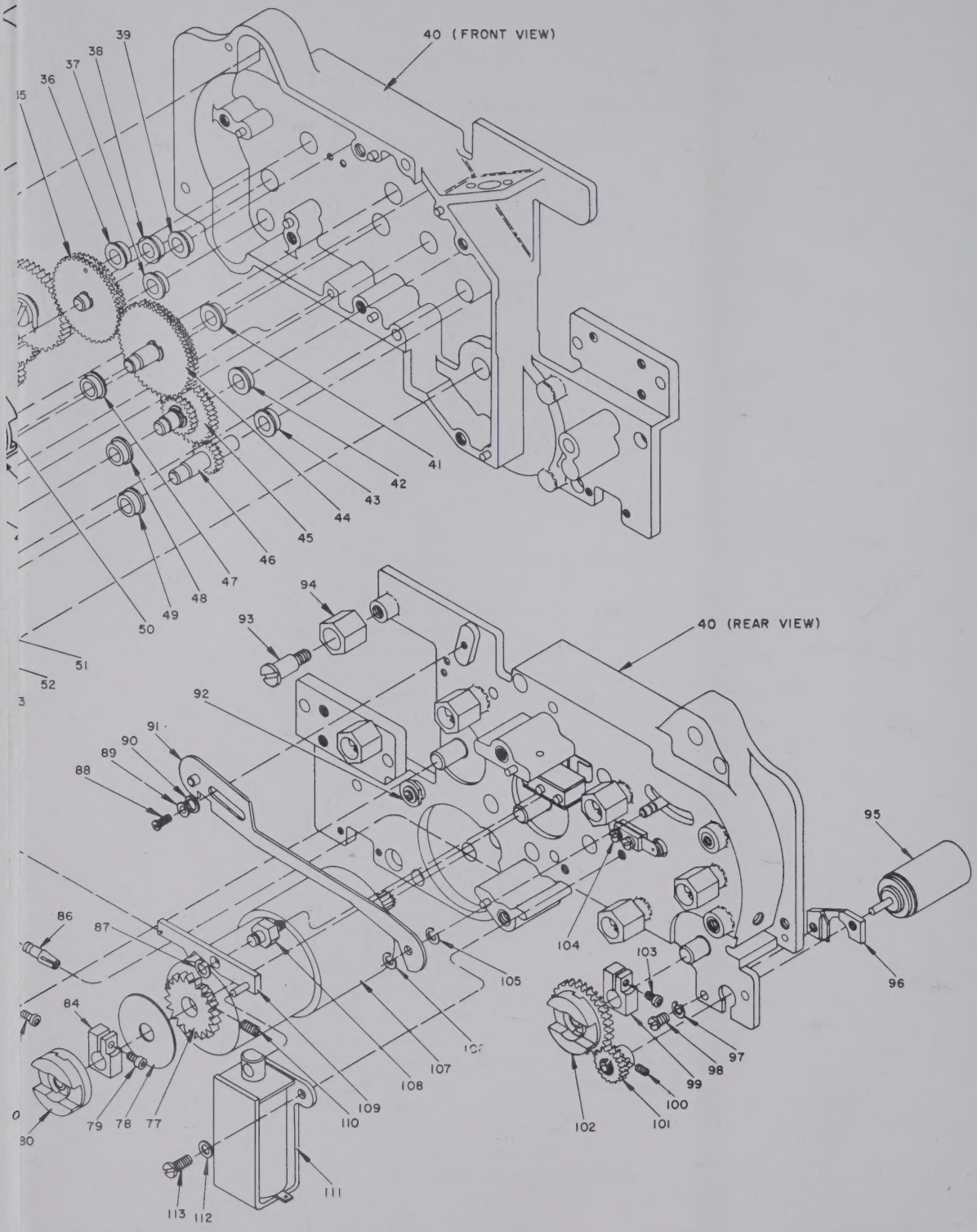


Figure 62. Receiver-Transmitter, Radio RT-246/VRC, front-panel year train assembly, exploded view.



TM5820-399-35-34


40 (FRONT VIEW)
40 (REAR VIEW)
TM5820-399-35-34

1 Mask spring pin
2 Mask spring
3 Dial assembly 72-tooth kc gear retaining ring
4 Shim
5 Shim
6 Mask assembly
7 Mask assembly shim
8 Band switch gear retaining ring
9 Channel-selector mask
10 Band switch gear
11 Band switch gear setscrew
12 Mc dial and gear assembly
13 Band switch shaft
14 110-tooth gear securing screw
15 110-tooth gear washer
16 110-tooth gear
17 Shaft and 20-tooth gear assembly retaining ring
18 Lower gear plate securing screw
19 Lower gear plate securing screw washer
20 Lower gear plate
21 Lower gear plate bearing
22 Center gear plate bearing
23 120-tooth gear assembly
24 120-tooth gear assembly spacer
25 Mc detent ball
26 Mc shaft and 52-tooth gear assembly
27 Mc detent spring
28 Lower gear plate bearing
29 Spring and contact assembly
30 Spring and contact assembly rivet
31 Left shaft and 20-tooth gear assembly
32 Left shaft and 26- and 44-tooth gear assembly
33 Left shaft and 60-tooth gear assembly
34 Band switch shaft detent arm
35 Roll pin
36 Housing bearing
37 Housing bearing
38 Housing bearing
39 Housing
40 Band switch detent sleeve
41 Band switch arm retaining ring
42 Band switch arm retaining ring
43 Band switch arm
44 Detent ball
45 Detent spring
46 Detent spring setscrew
47 Kc detent gear setscrew
48 Band switch arm spacer
49 Band switch arm securing screw washer
50 Band switch arm securing screw
51 Kc detent gear
52 Detent stop assembly
53 Housing bearing
54 Housing bearing
55 Housing bearing
56 Housing bearing
57 Housing bearing
58 Right shaft and 26- and 44-tooth gear assembly
59 Right shaft and 20-tooth gear assembly
60 Right shaft and 60-tooth gear assembly
61 Right gear plate bearing
62 Right gear plate bearing
63 Center gear plate bearing
64 Housing bearing
65 Housing bearing
66 Housing bearing
67 Shaft and 15- and 45-tooth gear assembly
68 Shaft and 37-tooth gear assembly
69 Kc shaft and 15- and 45-tooth gear assembly
70 Center gear plate bearing
71 Center gear plate bearing
72 Right gear plate
73 Right gear plate securing screw washer
74 Right gear plate securing screw
75 Center gear plate
76 Center gear plate securing screw washer
77 Center gear plate securing screw
78 25-tooth gear
79 Dial assembly 72-tooth kc gear
80 Cam and 72-tooth gear assembly
81 Cam and 72-tooth gear assembly setscrew
82 KC dial
83 Kc dial shim
84 Kc detent spring setscrew
85 Kc detent spring
86 Kc detent ball
87 Kc detent sleeve
88 Blade assembly

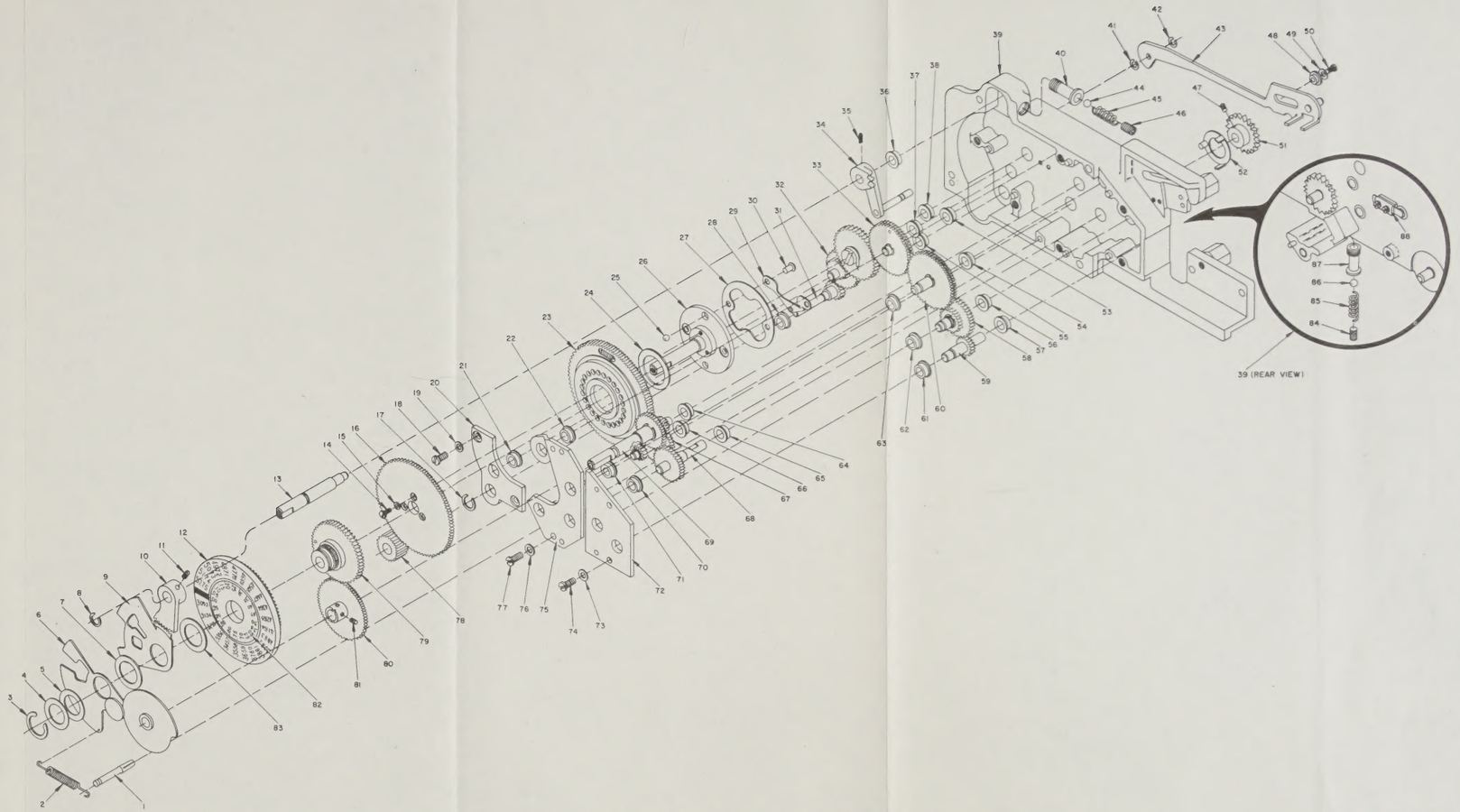
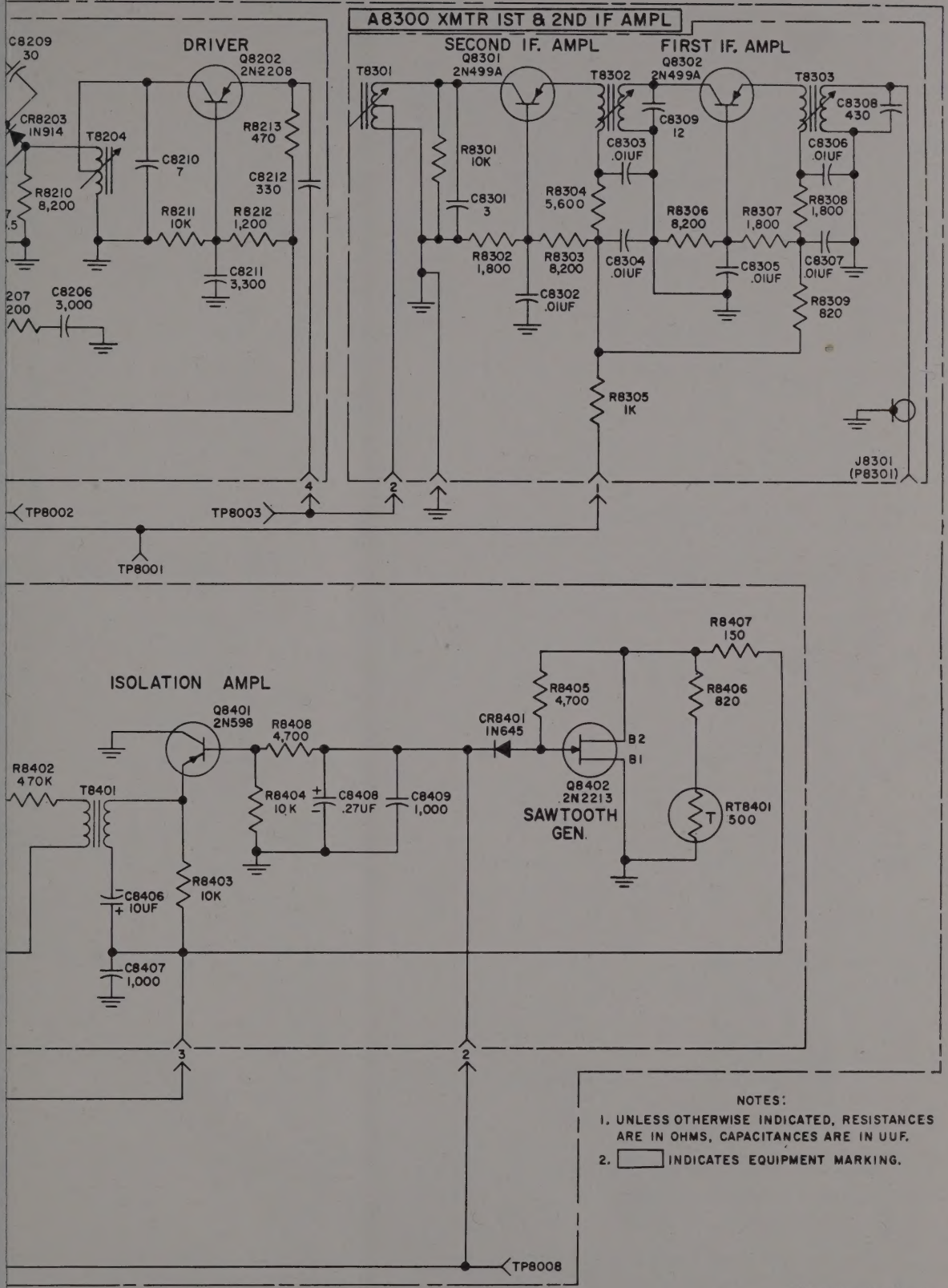


Figure 63. Receiver-Transmitter, Radio RT-524/VRC front-panel gear train assembly, exploded view.

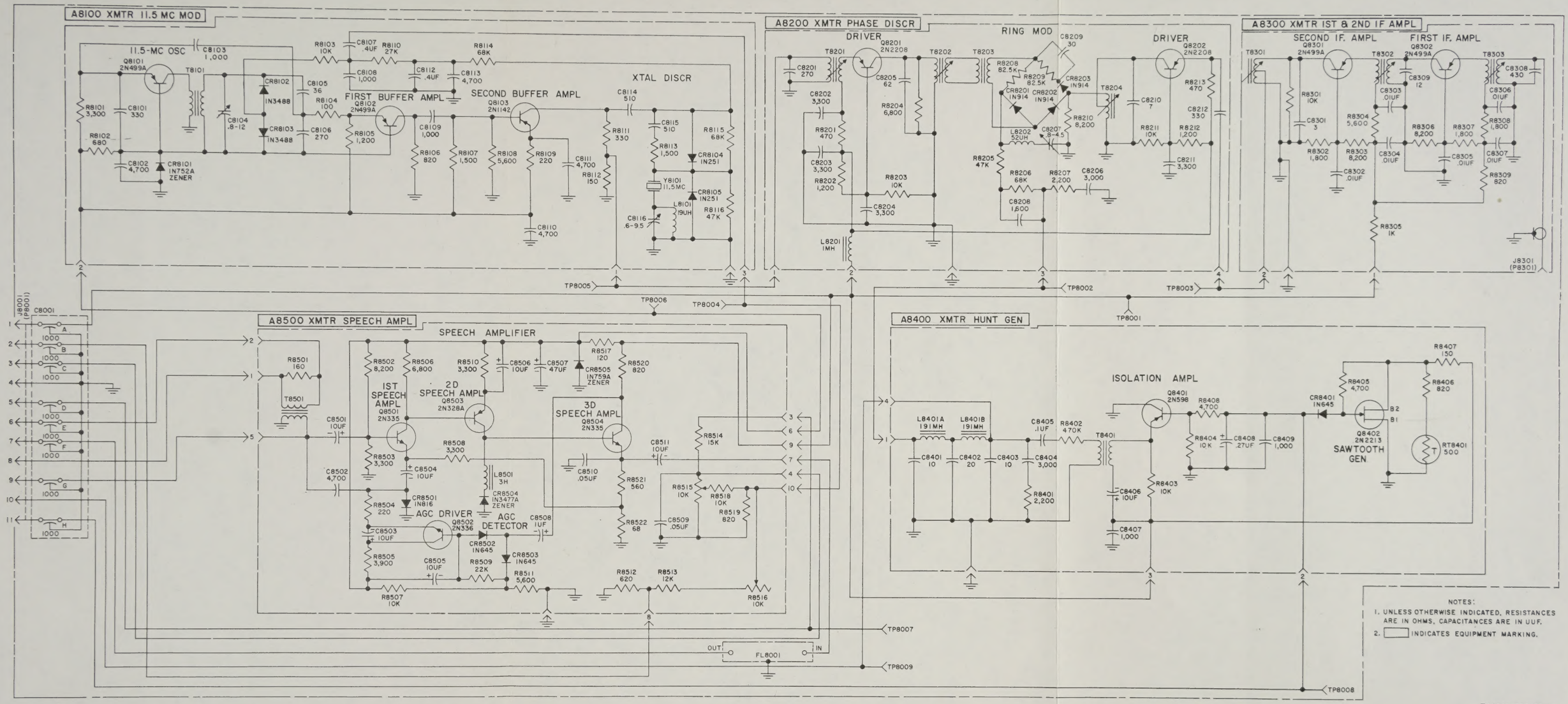
TM5820-399-35-35



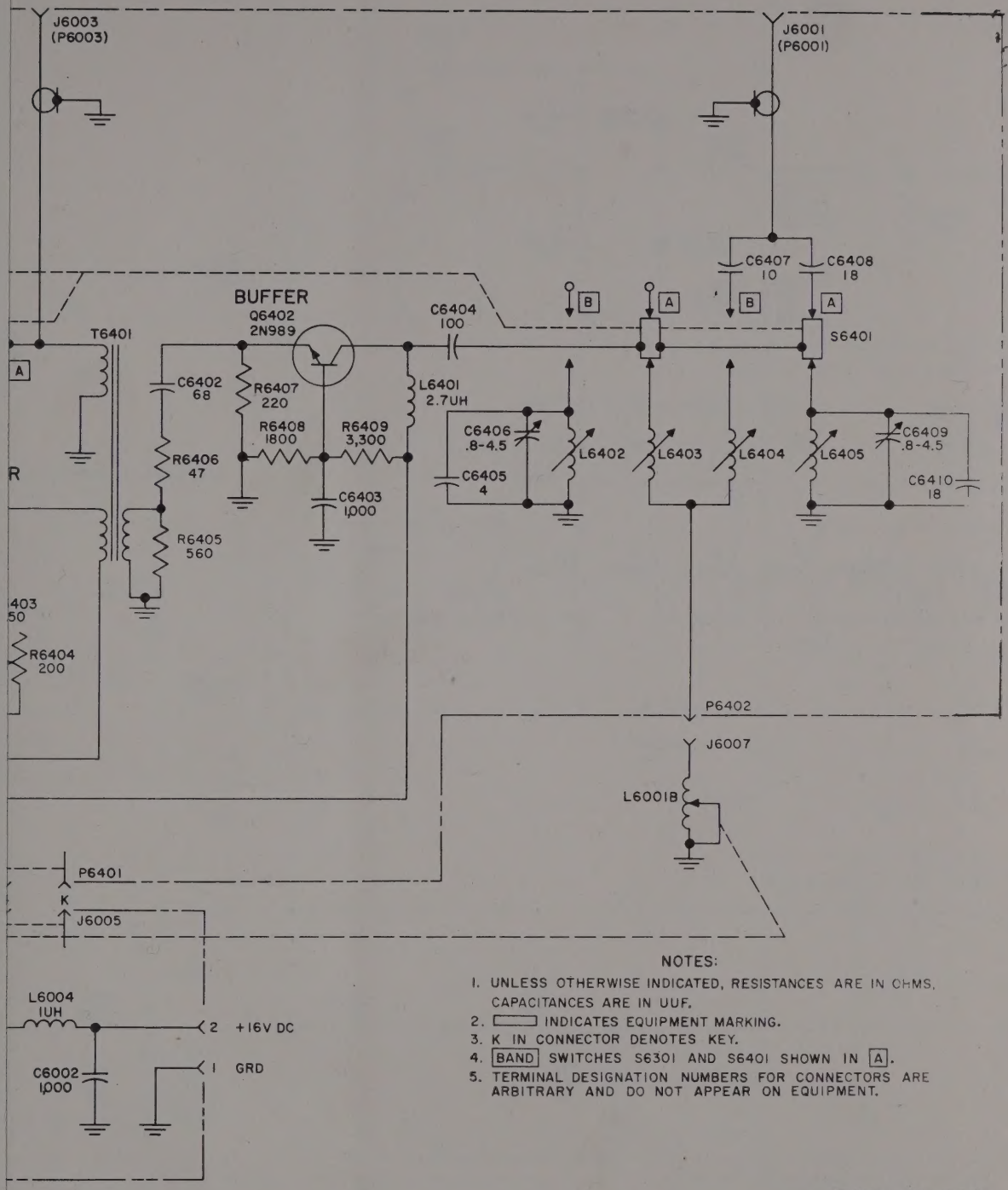
NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. ☐ INDICATES EQUIPMENT MARKING.

TM 5820-399-35-61



TM 5820-399-35-61



l buffer amplifiers, schematic diagram.

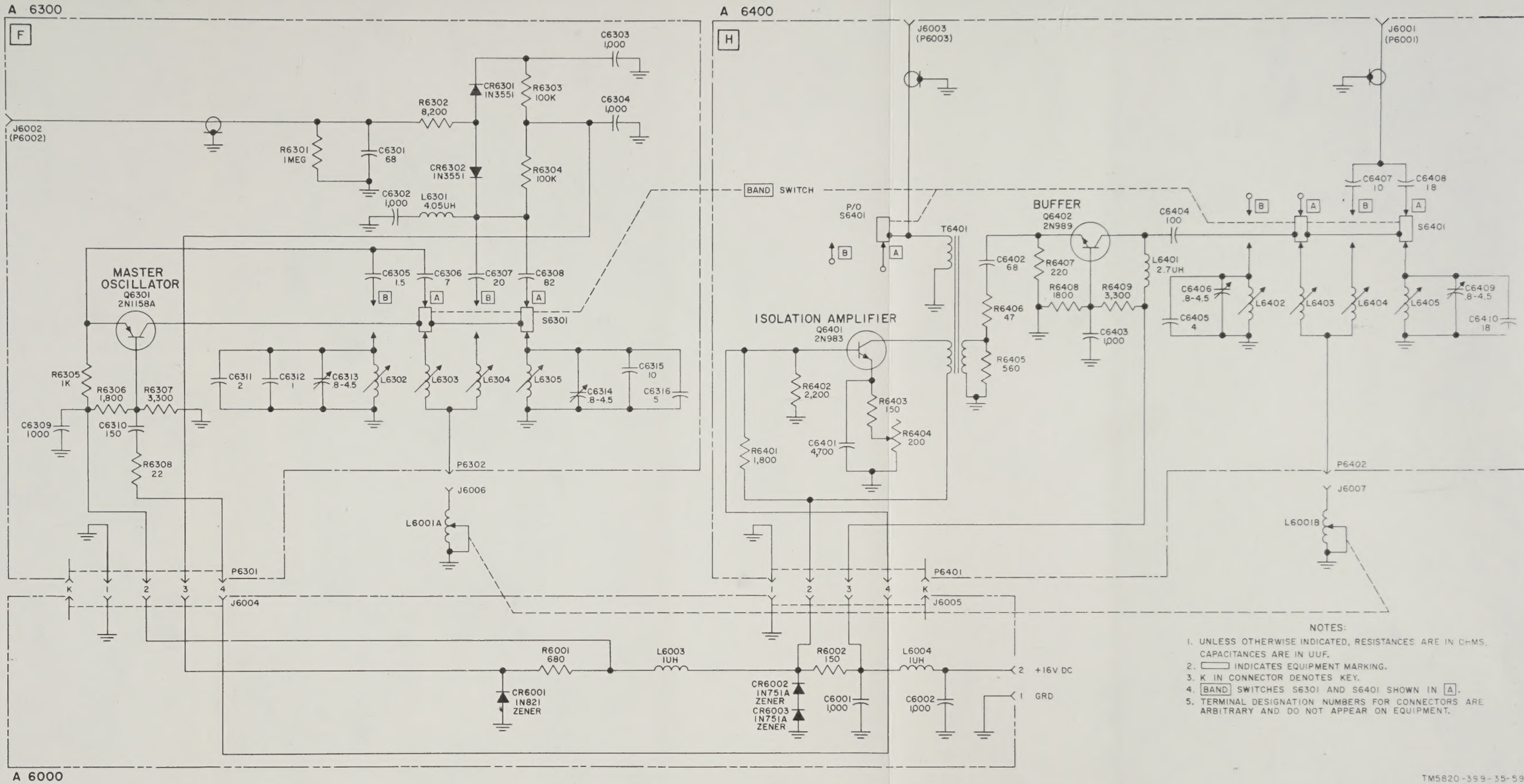
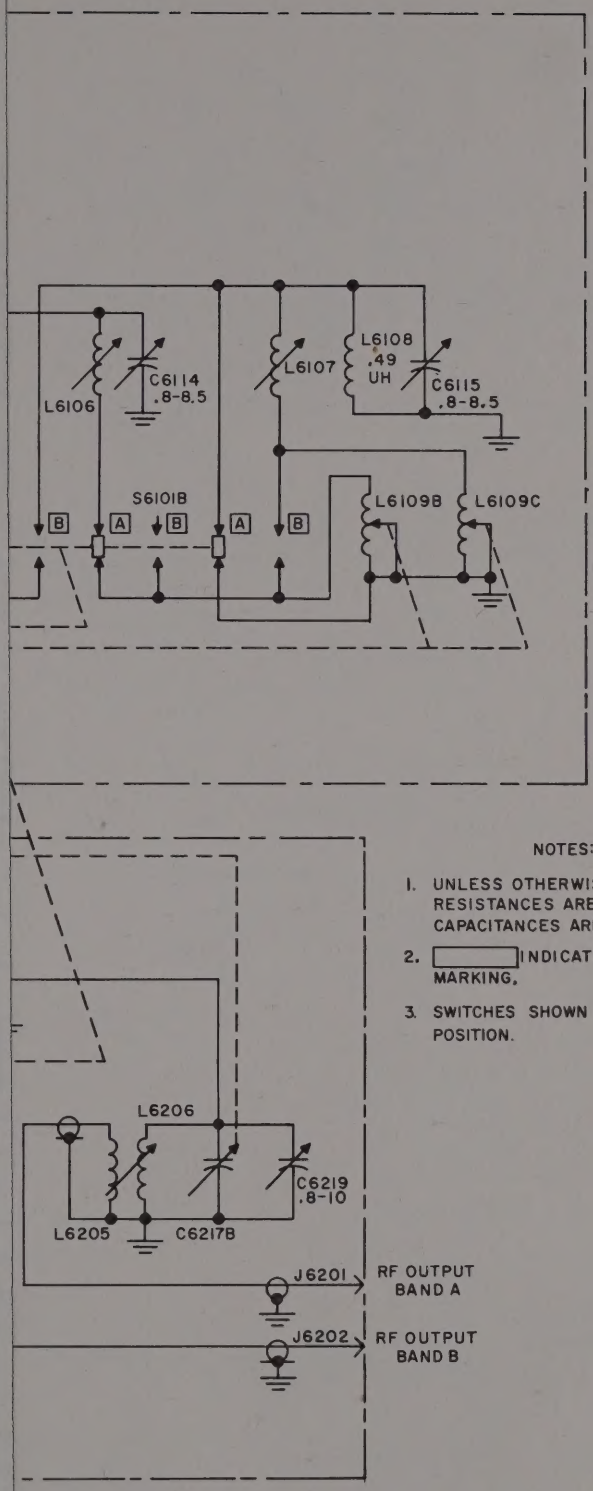


Figure 65. Receiver-transmitter master oscillator and buffer amplifiers, schematic diagram.

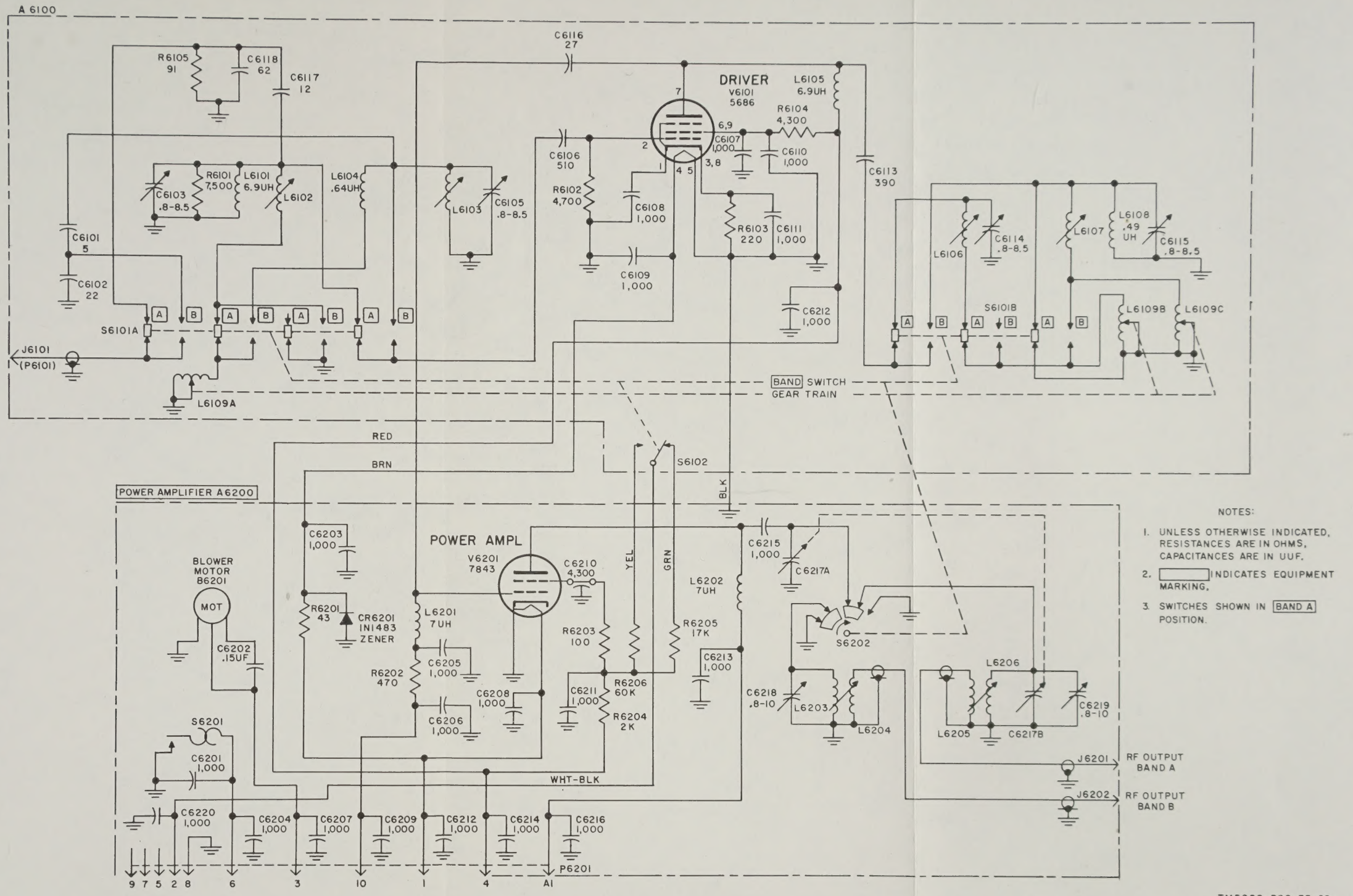


NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. [ ] INDICATES EQUIPMENT MARKING.
3. SWITCHES SHOWN IN [BAND A] POSITION.

TM5820-399-35-60

chematic diagram.

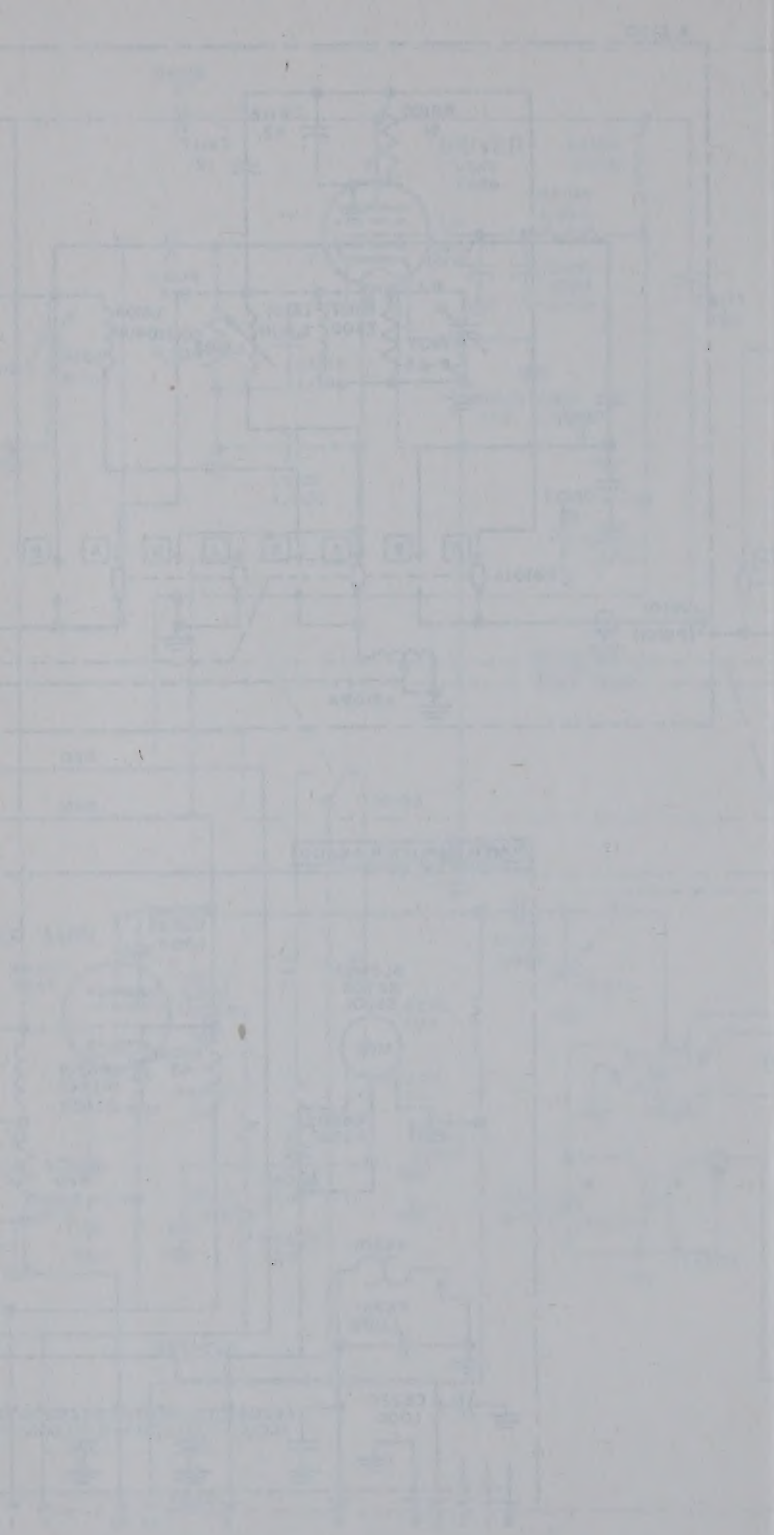


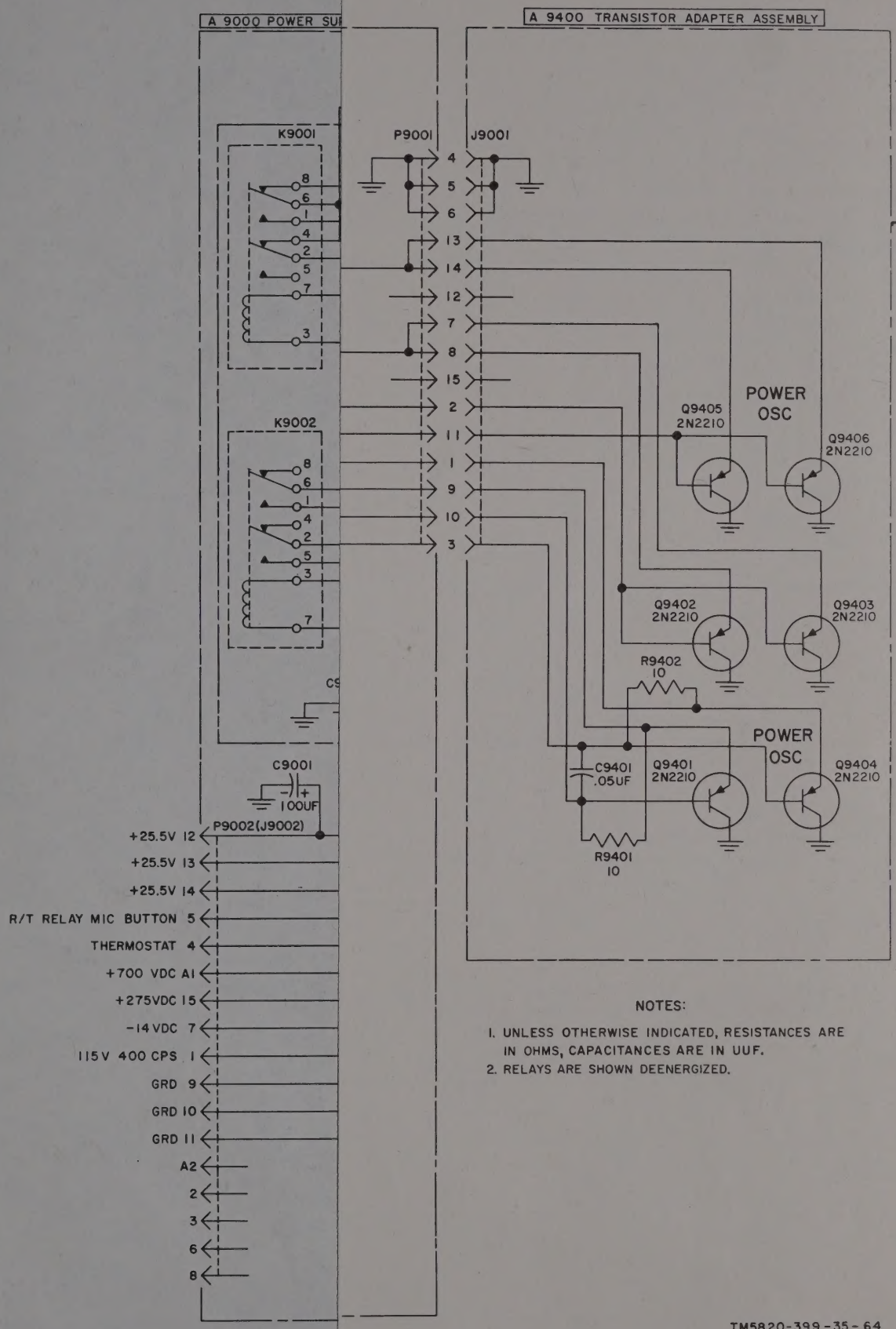
NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. [ ] INDICATES EQUIPMENT MARKING.
3. SWITCHES SHOWN IN BAND A POSITION.

TM5820-399-35-60

Figure 66. Receiver-transmitter driver and power amplifier, schematic diagram.

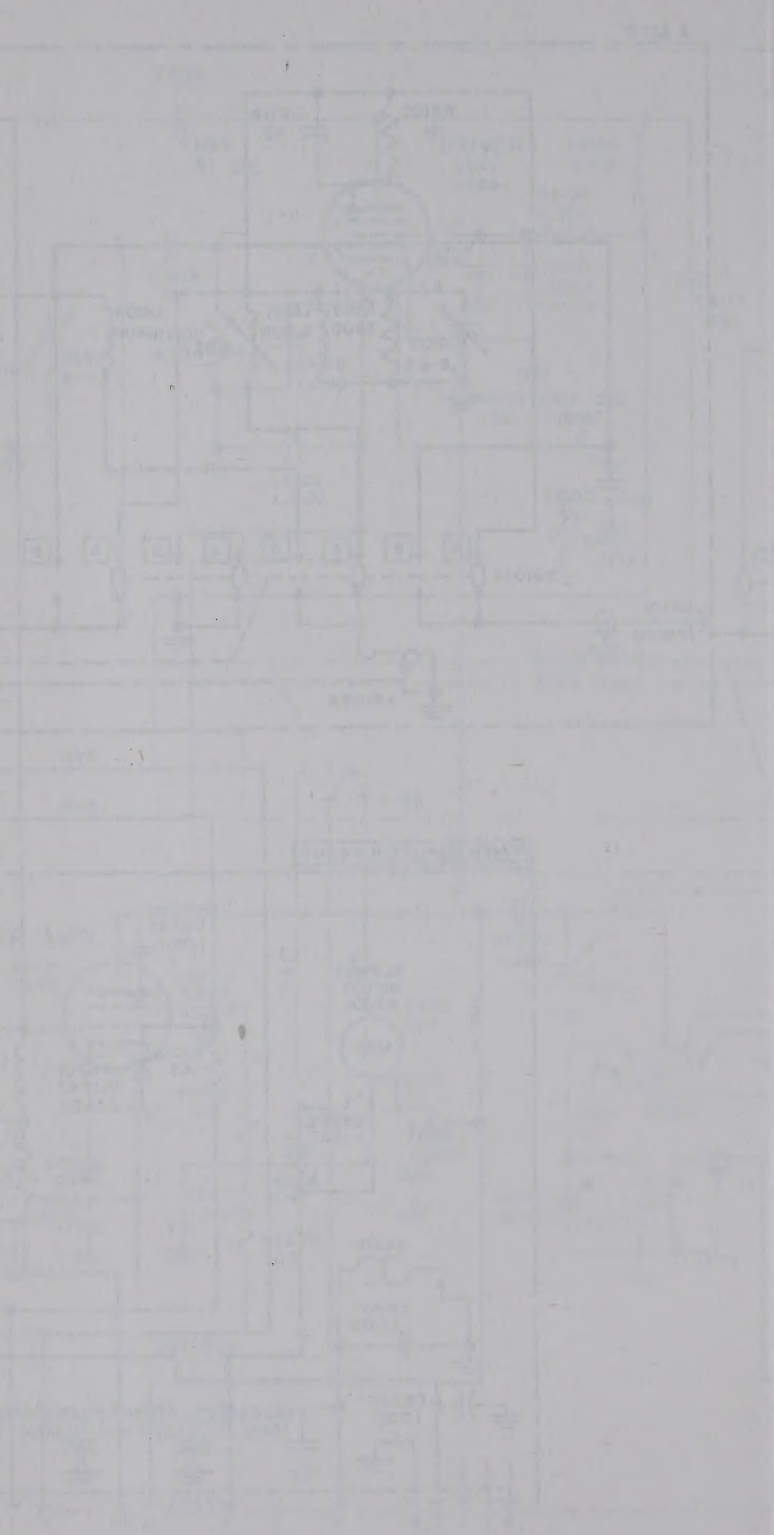




NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. RELAYS ARE SHOWN DEENERGIZED.

TM5820-399-35-64



A 9000 POWER SUPPLY ASSEMBLY

A 9400 TRANSISTOR ADAPTER ASSEMBLY

K9001

K9002

TP9001

TP9002

T9001

T9002

+700 VDC RECT

+275 VDC RECT

BIAS RECT

CR9001 1N645

CR9002 1N648

CR9003 1N648

CR9004 1N648

CR9005 1N648

CR9006 1N649

CR9007 1N649

CR9008 1N649

CR9009 1N649

CR9010 1N649

CR9011 1N649

CR9012 1N649

CR9013 1N649

CR9014 1N645

CR9015 1N1202

R9001 150K

R9002 150K

R9003 150K

R9004 150K

R9005 50

R9006 390

R9007 270

R9008 10

R9009 18

R9010 18

R9011 180

R9012 1K

R9401 10

R9402 10

C9001 100UF

C9002 150UF

C9003 8UF

C9004 8UF

C9005 8UF

C9006 1,000

C9007 8UF

C9008 390

C9009 2UF

C9010 4.7UF

C9011 2UF

C9012 2UF

C9401 .05UF

L9001 2MH

L9002 124MH

L9003 130MH

P9001 J9001

P9002(J9002)

P9003 J9003

Q9401 2N2210

Q9402 2N2210

Q9403 2N2210

Q9404 2N2210

Q9405 2N2210

Q9406 2N2210

POWER OSC

POWER OSC

+25.5V 12

+25.5V 13

+25.5V 14

R/T RELAY MIC BUTTON 5

THERMOSTAT 4

+700 VDC A1

+275VDC 15

-14 VDC 7

115 V 400 CPS 1

GRD 9

GRD 10

GRD 11

A2

2

3

6

8

TP9004

TP9005

TP9006

TP9007

YEL

GRN

BLU

VIO

GY

WHT

ORN

RED

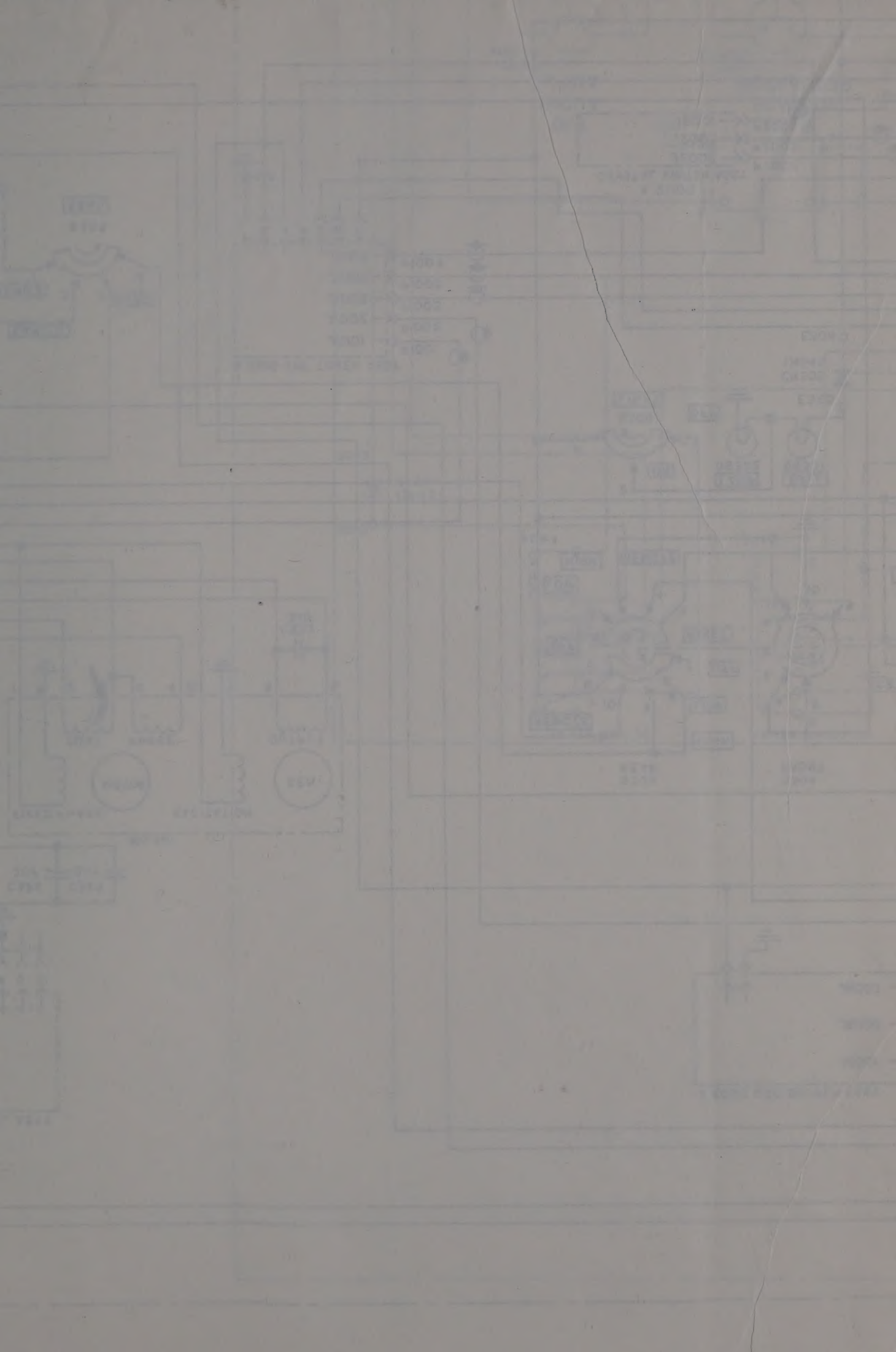
BRN

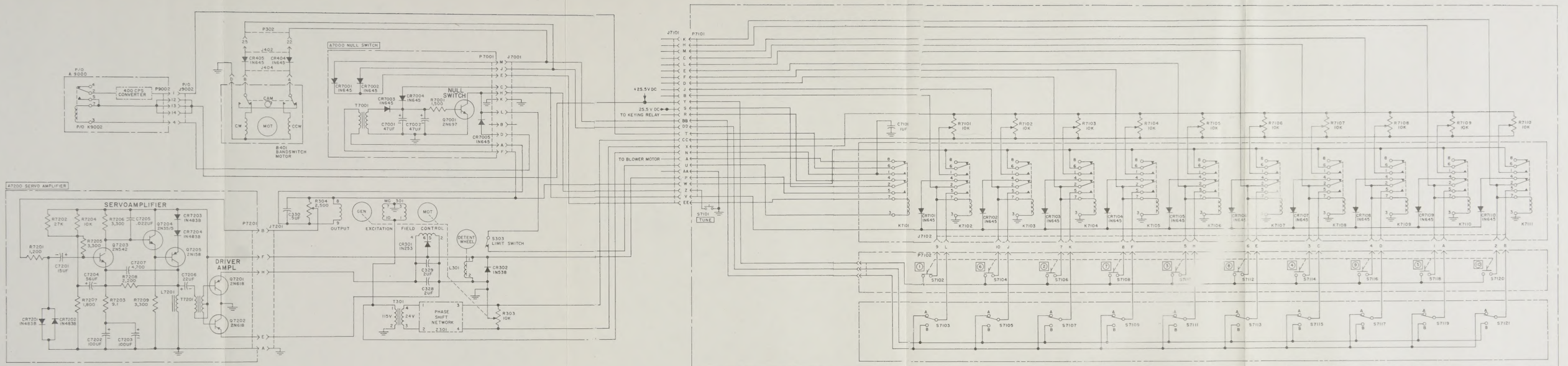
NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. RELAYS ARE SHOWN DEENERGIZED.

TM5820-399-35-64

Figure 67. Receiver-transmitter power supply, schematic diagram.

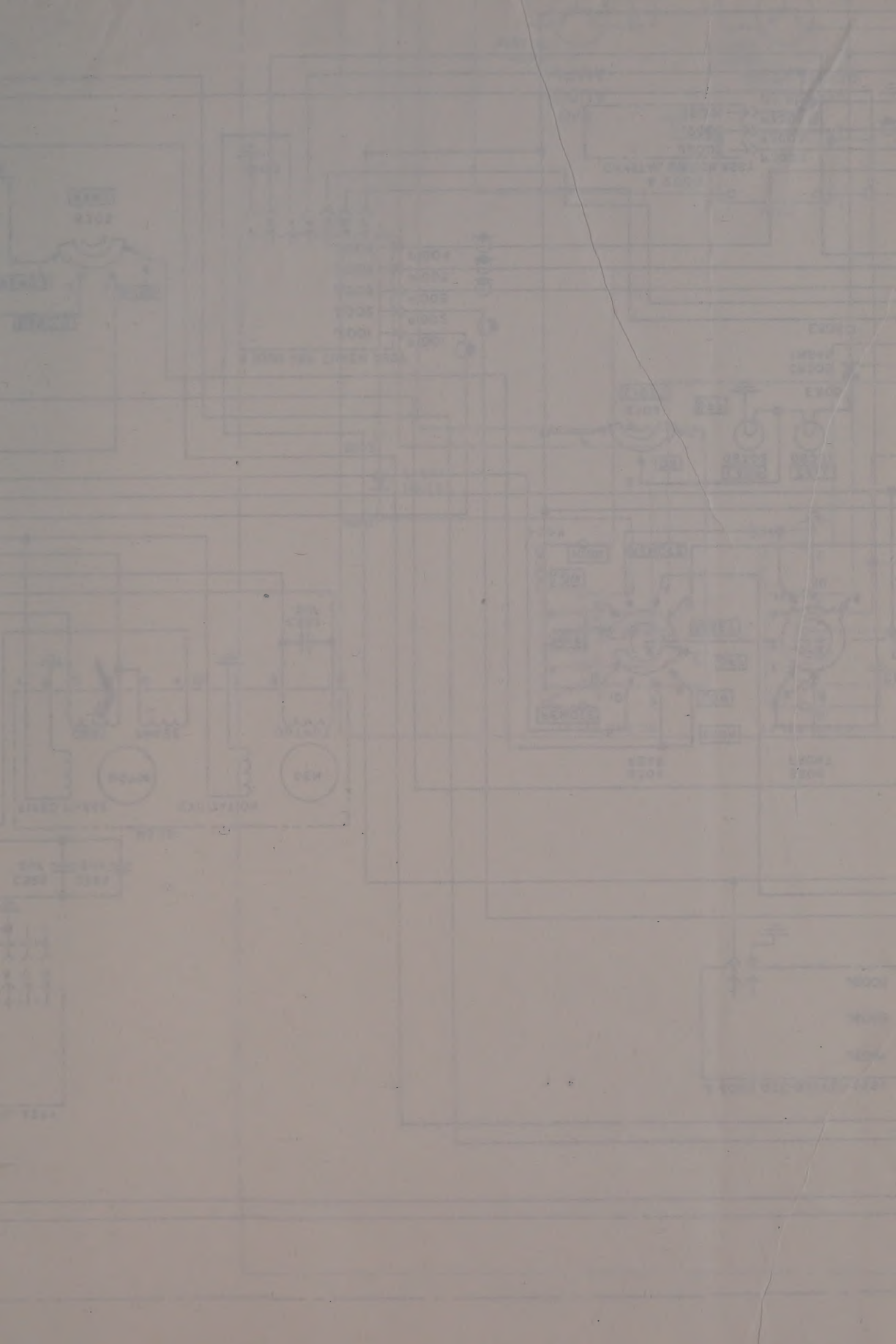


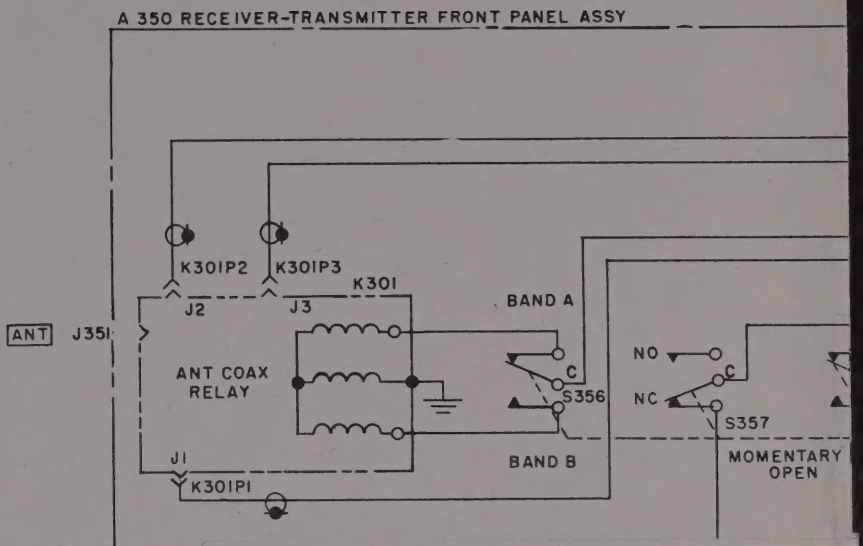


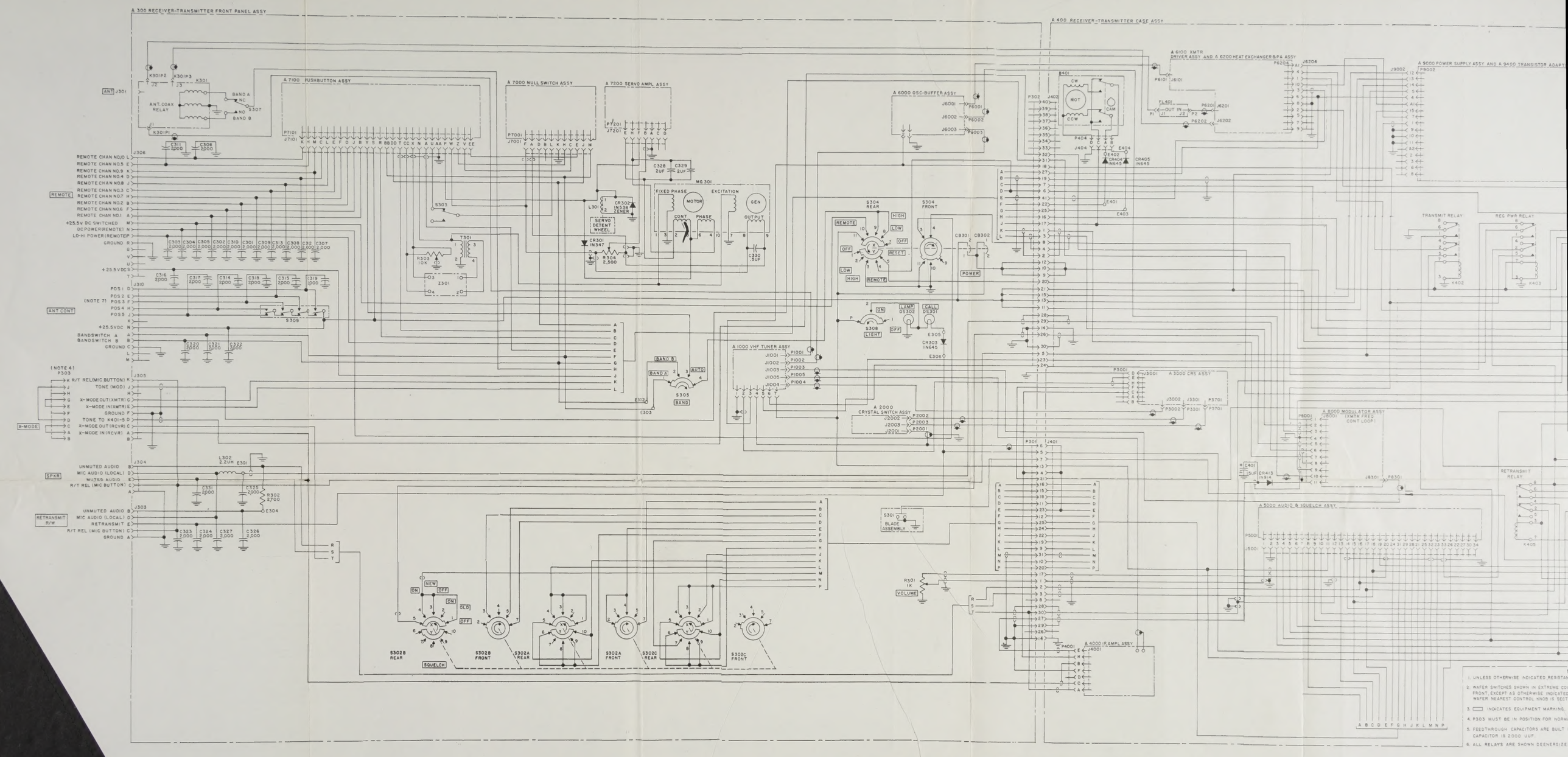
NOTES:
1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. ▭ INDICATES EQUIPMENT MARKING.
3. SWITCHES S7102 AND S303 ARE SHOWN CLOSED, BAND SWITCHES ARE SHOWN IN A.
4. ALL RELAYS SHOWN DEENERGIZED.

TM5820-399-35-63

Figure 68. Receiver-Transmitter, Radio RT-246/VRC automatic frequency selection system, schematic diagram.




A 350 RECEIVER-TRANSMITTER FRONT PANEL ASSY
K301P2
K301P3
K301
J2
J3
BAND A
ANT
J351
ANT COAX
RELAY
C
S356
NO
C
NC
S357
MOMENTARY
OPEN
BAND B
J1
K301P1


A 300 RECEIVER-TRANSMITTER FRONT PANEL ASSY
A 400 RECEIVER-TRANSMITTER CASE ASSY
A 7100 PUSHBUTTON ASSY
A 7000 NULL SWITCH ASSY
A 7200 SERVO AMPL ASSY
A 6000 OSC-BUFFER ASSY
A 6100 XMTR DRIVER ASSY AND A 6200 HEAT EXCHANGER & PA ASSY
A 9000 POWER SUPPLY ASSY AND A 9400 TRANSISTOR ADAPT
A 1000 VHF TUNER ASSY
A 2000 CRYSTAL SWITCH ASSY
A 3000 CRS ASSY
A 4000 IF AMPL ASSY
A 5000 AUDIO & SQUELCH ASSY
A 8000 MODULATOR ASSY
ANT J301
REMOTE
ANT CONT
X-MODE
SPKR
RETRANSMIT R/W
ANT. COAX RELAY
BAND A
BAND B
MG 301
FIXED PHASE
EXCITATION
MOTOR
GEN
CONT
PHASE
OUTPUT
SERVO DETENT WHEEL
TRANSMIT RELAY
REG PWR RELAY
RETRANSMIT RELAY
BLADE ASSEMBLY
VOLUME
SQUELCH
S302B REAR
S302B FRONT
S302A REAR
S302A FRONT
S302C REAR
S302C FRONT
S303
S304 REAR
S304 FRONT
S305 BAND
S307
S308 LIGHT
S309
S310
S311
S312
S313
S314
S315
S316
S317
S318
S319
S320
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S348

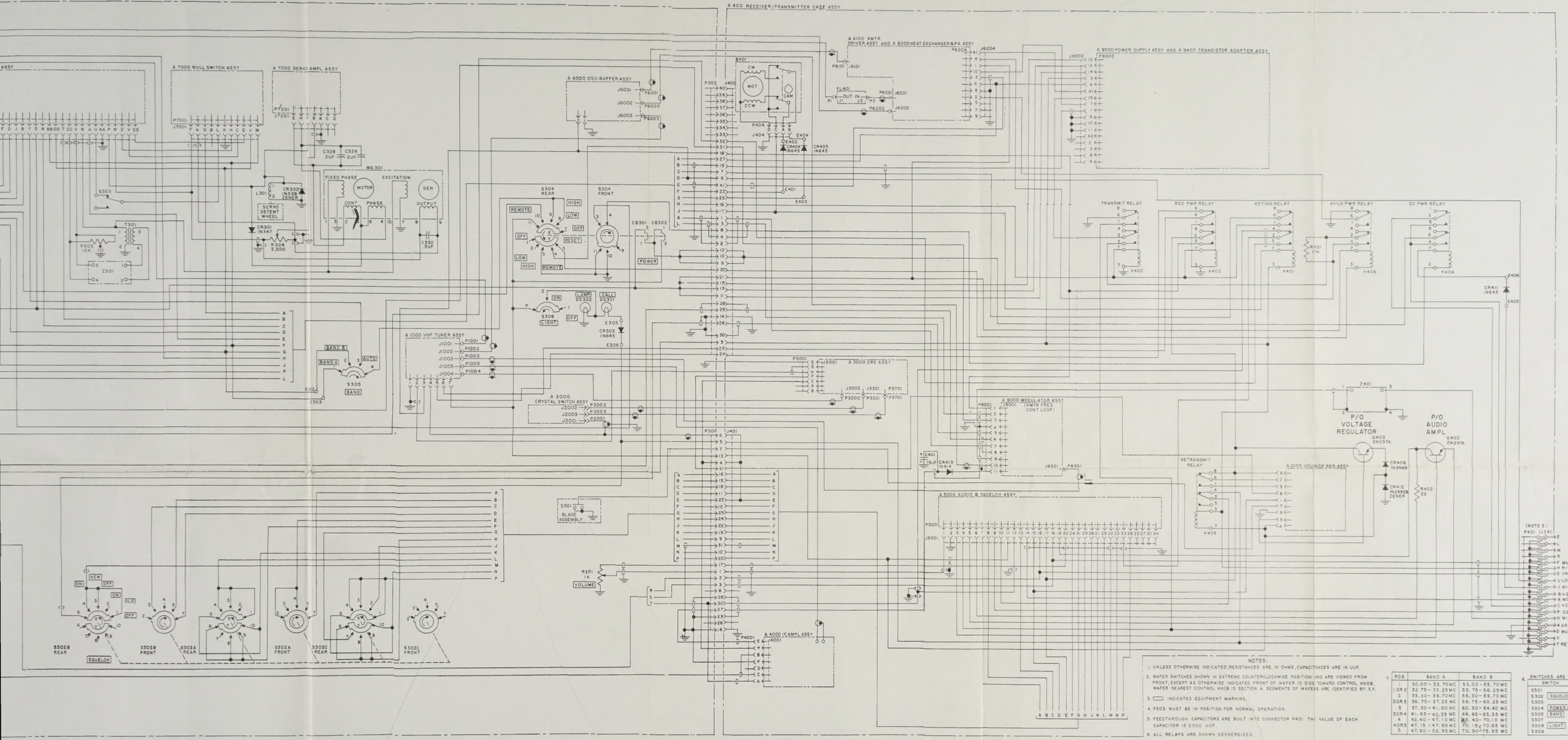

Figure 69. Receiver-Transmitter, Radio RT-840/VRC front panel and case assemblies, schematic diagram.

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. WAFER SWITCHES SHOWN IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT AS OTHERWISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A. SEGMENTS OF WAFERS ARE IDENTIFIED BY X,Y.
3. ▭ INDICATES EQUIPMENT MARKING.
4. P303 MUST BE IN POSITION FOR NORMAL OPERATION.
5. FEEDTHROUGH CAPACITORS ARE BUILT INTO CONNECTOR P401. THE VALUE OF EACH CAPACITOR IS 2000 UUF.
6. ALL RELAYS ARE SHOWN DEENERGIZED.

POS	BAND A	BAND B
1	30.00 - 32.70 MC	53.00 - 55.70 MC
1 OR 2	32.75 - 33.25 MC	55.75 - 56.25 MC
2	33.30 - 36.70 MC	56.30 - 59.70 MC
2 OR 3	36.75 - 37.25 MC	59.75 - 60.25 MC
3	37.30 - 41.60 MC	60.30 - 64.60 MC
3 OR 4	41.65 - 42.35 MC	64.65 - 65.35 MC
4	42.40 - 47.10 MC	65.40 - 70.10 MC
4 OR 5	47.15 - 47.85 MC	70.15 - 70.85 MC
5	47.90 - 52.95 MC	70.90 - 75.95 MC

7.

8. SWITCHES ARE SHOWN AS FOLLOWS:

SWITCH		POSITION
S301		OPEN
S302	SQUELCH	OLD OFF
S303		CLOSED
S304	POWER	OFF
S305	BAND	BAND A
S307		BAND A
S308	LIGHT	OFF
S309		5

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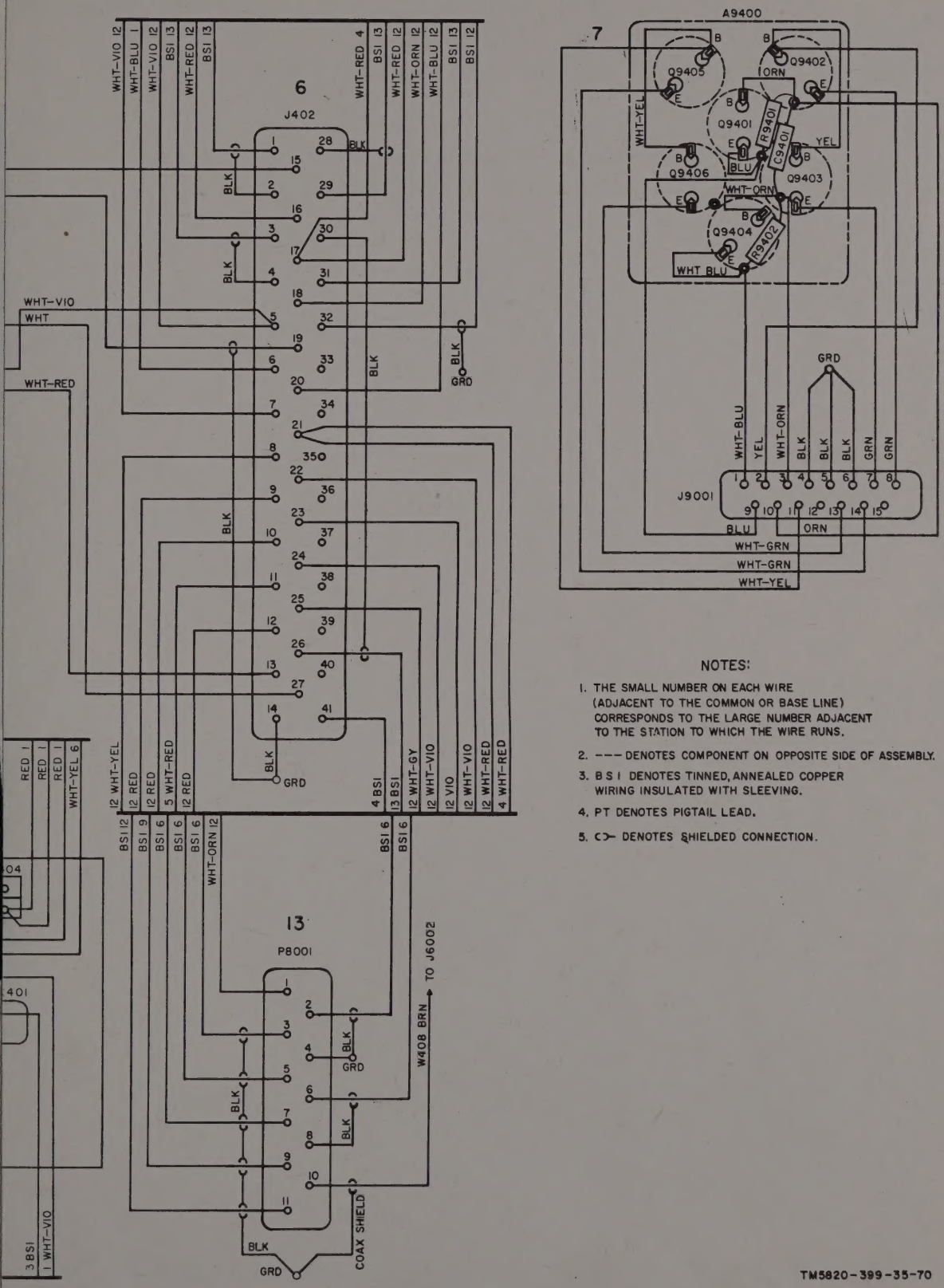

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. --- DENOTES COMPONENT ON OPPOSITE SIDE OF ASSEMBLY.
3. BSI DENOTES TINNED, ANNEALED COPPER WIRING INSULATED WITH SLEEVING.
4. PT DENOTES PIGTAIL LEAD.
5. ⊂⊃ DENOTES SHIELDED CONNECTION.

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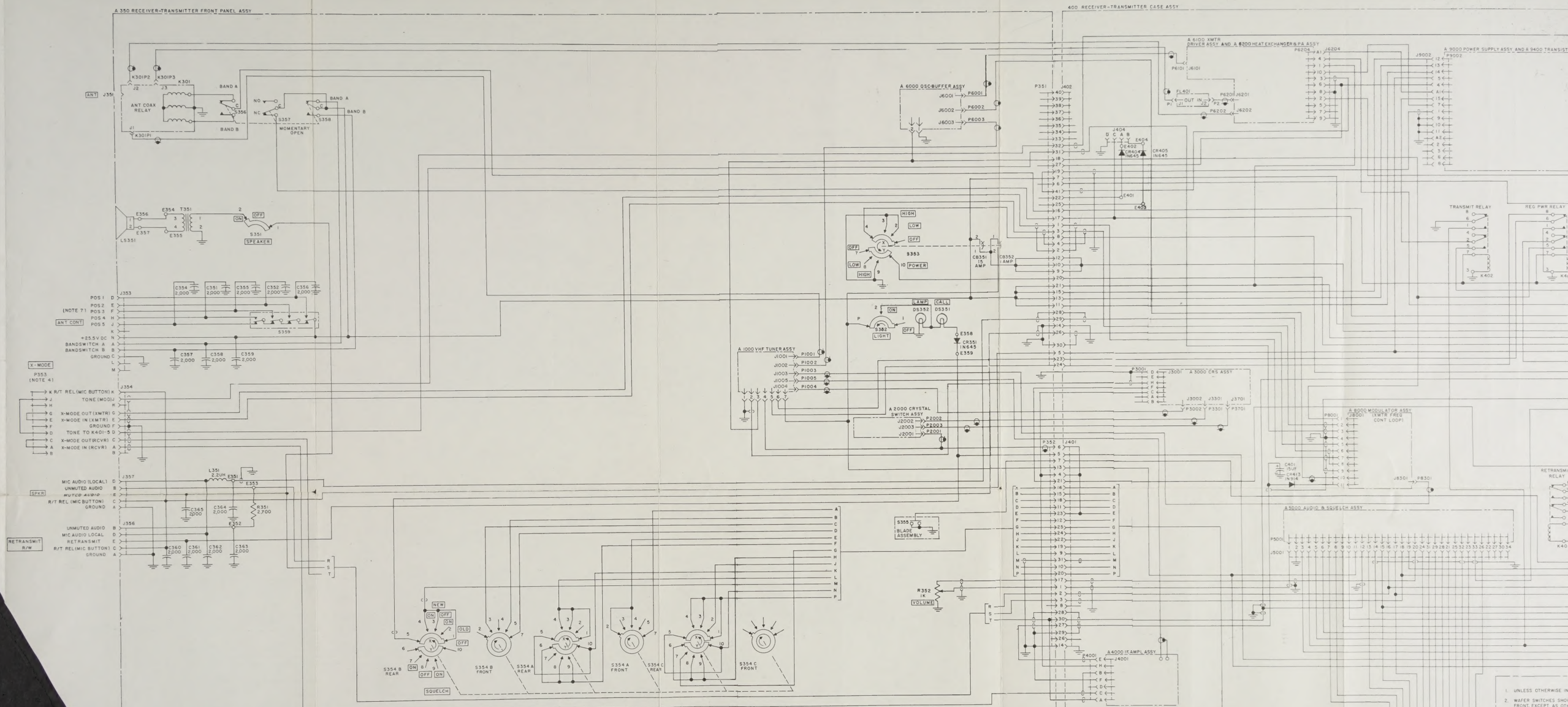

Figure 70. Receiver-Transmitter, Radio RT-524/VRC front panel and case assemblies, schematic diagram.

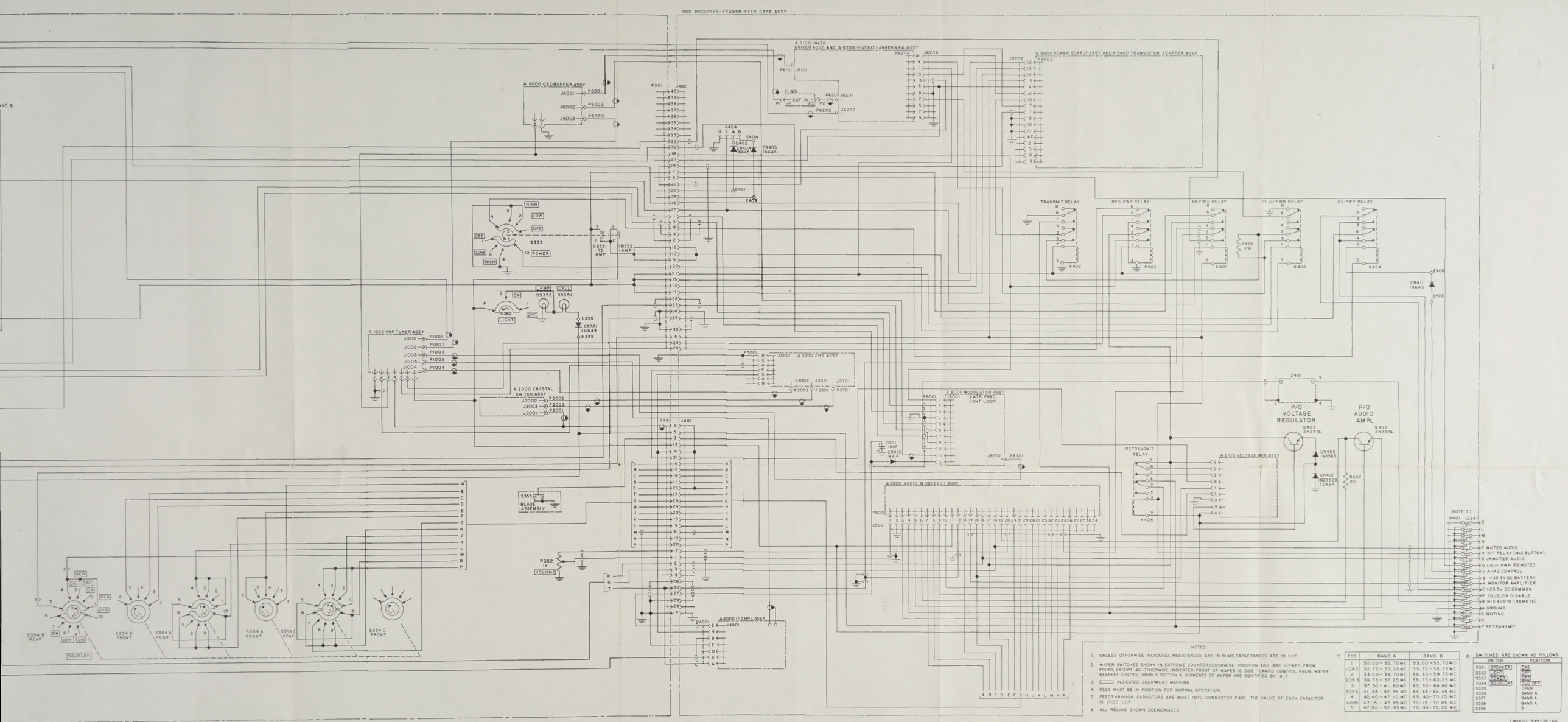

Figure 70. Receiver-Transmitter, Radio RT-524/VRC front panel and case assemblies, schematic diagram.

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. WAFER SWITCHES SHOWN IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT AS OTHERWISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A. SEGMENTS OF WAFER ARE IDENTIFIED BY X,Y.
3. ⊏⊐ INDICATES EQUIPMENT MARKING.
4. P353 MUST BE IN POSITION FOR NORMAL OPERATION.
5. FEEDTHROUGH CAPACITORS ARE BUILT INTO CONNECTOR P401. THE VALUE OF EACH CAPACITOR IS 2000 UUF.
6. ALL RELAYS SHOWN DEENERGIZED.

7

POS	BAND A	BAND B
1	30.00 – 32.70 MC	53.00 – 55.70 MC
1 OR 2	32.75 – 33.25 MC	55.75 – 56.25 MC
2	33.00 – 36.70 MC	56.30 – 59.70 MC
2 OR 3	36.75 – 37.25 MC	59.75 – 60.25 MC
3	37.30 – 41.60 MC	60.30 – 64.60 MC
3 OR 4	41.65 – 42.35 MC	64.65 – 65.35 MC
4	42.40 – 47.10 MC	65.40 – 70.10 MC
4 OR 5	47.15 – 47.85 MC	70.15 – 70.85 MC
5	47.90 – 52.95 MC	70.90 – 75.95 MC

8 SWITCHES ARE SHOWN AS FOLLOWS:

SWITCH	POSITION
S351	SPEAKER: ON
S352	PHONE: OFF
S353	SPEAKER: OFF
S354	SQUELCH: ON-OFF
S355	OPEN
S356	BAND A
S357	BAND A
S358	BAND A
S359	5

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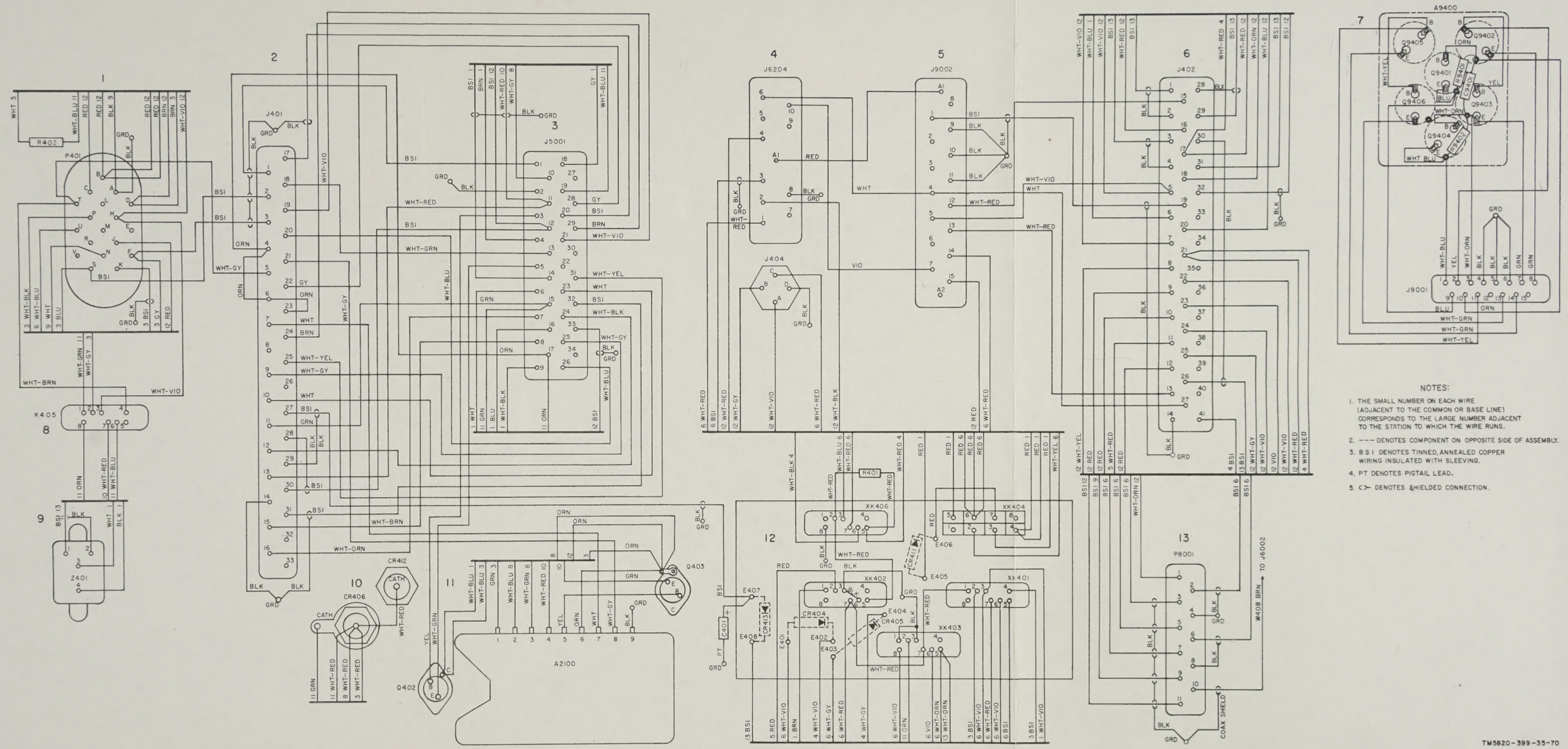
NOTES:
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. --- DENOTES COMPONENT ON OPPOSITE SIDE OF ASSEMBLY.
3. BSI DENOTES TINNED, ANNEALED COPPER WIRING INSULATED WITH SLEEVING.
4. PT DENOTES PIGTAIL LEAD.
5. DENOTES SHIELDED CONNECTION.
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Figure 71. Receiver-transmitter case assembly, wiring diagram.

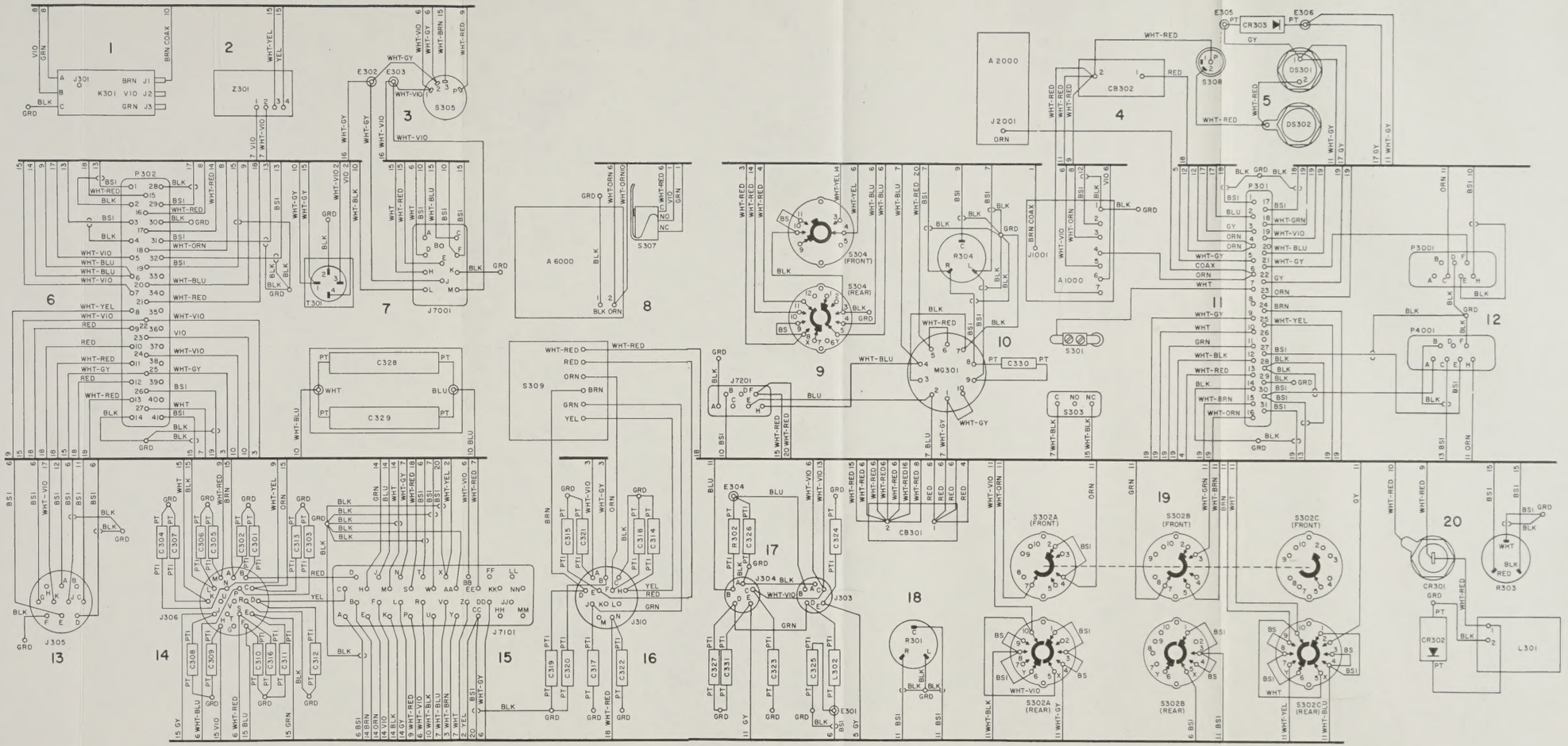
NOTES:
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. BS DENOTES TINNED, ANNEALED COPPER WIRING.
3. BSI DENOTES TINNED, ANNEALED COPPER WIRING INSULATED WITH SLEEVING.
4. PT DENOTES PIGTAIL LEAD.
5. PTI DENOTES PIGTAIL LEAD INSULATED WITH SLEEVING.
6. C DENOTES SHIELDED CONNECTION.

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Figure 72. Receiver-Transmitter, Radio RT-246/VRC front-panel assembly, wiring diagram.

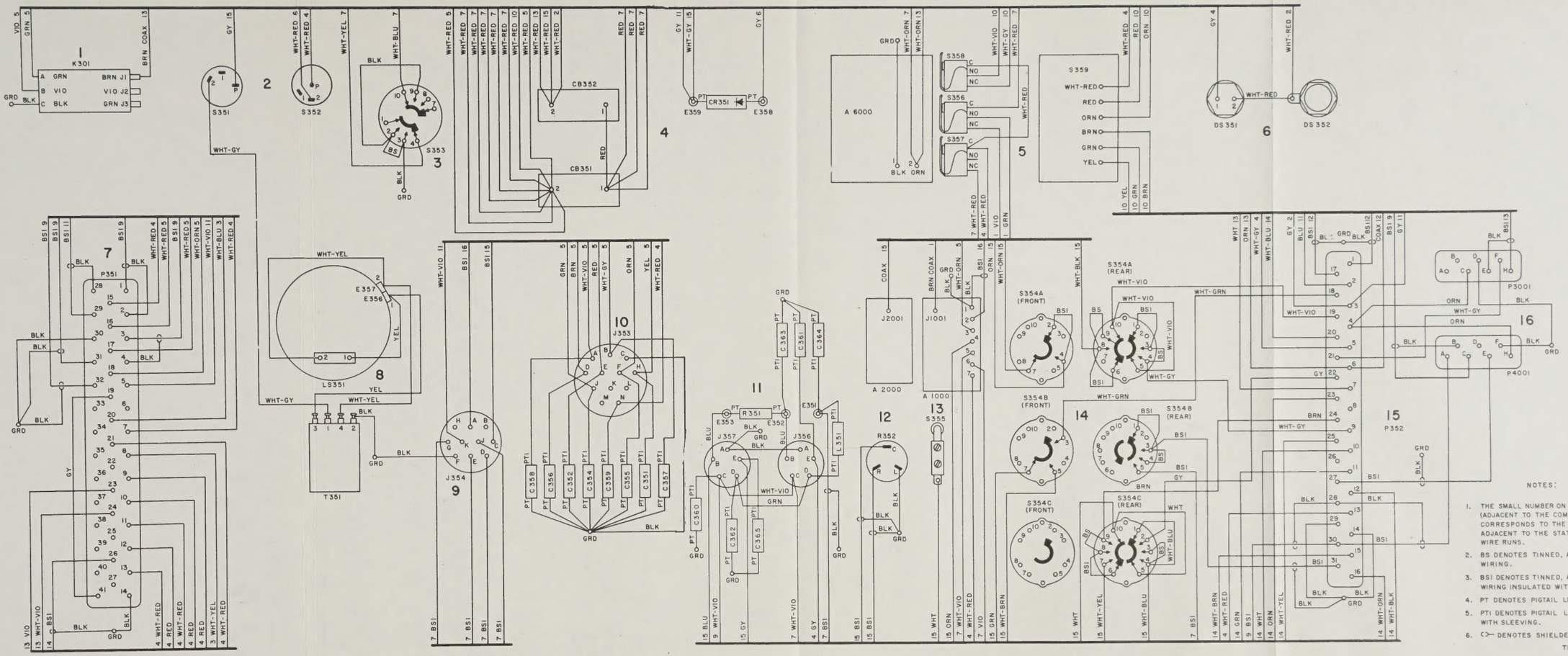
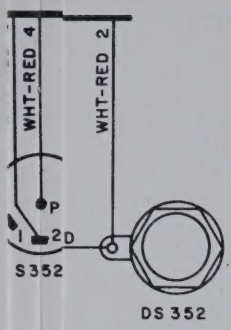
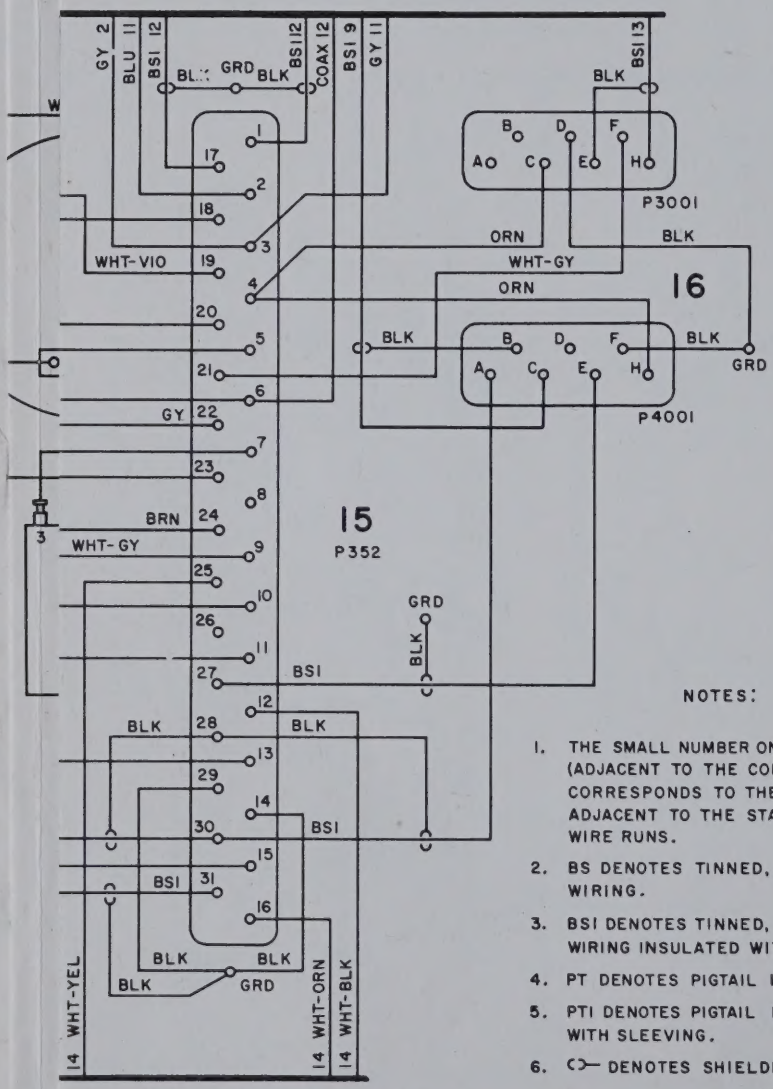


Figure 73. Receiver-Transmitter, Radio RT-524/VRC front-panel assembly, wiring diagram.





NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. BS DENOTES TINNED, ANNEALED COPPER WIRING.
3. BSI DENOTES TINNED, ANNEALED COPPER WIRING INSULATED WITH SLEEVING.
4. PT DENOTES PIGTAIL LEAD.
5. PTI DENOTES PIGTAIL LEAD INSULATED WITH SLEEVING.
6. ⊂⊃ DENOTES SHIELDED CONNECTION.

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By Order of Secretary of the Army:

G. H. DECKER,
General, United States Army,
Chief of Staff.

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Distribution:

Active Army:

DASA (6)
USASA (2)
CNGB (1)
Tech Stf, DA (1)
except CSigO (14)
Tech Stf Bd (1)
USCONARC (5)
USAARTYBD (1)
USAARMBD (2)
USAIB (1)
USARADBD (2)
USAABELCTBD
USAAVNBD (1)
USAATBD (1)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
MDW (1)
Armies (2)
Corps (2)
Instl (2)
Ft Monmouth (63)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC FA (2)
USATC Inf (2)
USAOMC (3)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (2) except
Atlanta GENDEP (None)
Sig Sec, GENDEP (5)
Sig Dep (12)
WRAMC (1)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
OSA (1)
USAEPG (2)
AFIP (1)
AMS (1)
Army Pictorial Cen (2)
EMC (1)
Yuma Test Sta (2)
USA Strat Comm Comd (4)
USASSA (20)
USASSAMRO (1)
Def Log Svc Cen (1)
USA Caribbean Sig Agcy (1)
USA Sig Msl Spt Agcy (13)
Sig Fld Maint Shops (3)
USA Corps (3)
JBUSMC (2)
Units org under fol TOE:
11-7 (2)
11-16 (2)
11-57 (2)
11-98 (2)
11-117 (2)
11-155 (2)
11-157 (2)
11-500 (AA-AE) (4)
11-557 (2)
11-587 (2)
11-592 (2)
11-597 (2)

NG: State AG (3); Units – Same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

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